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TURF GRASS IRRIGATION RESEARCH AT THE UNIVERSITY OF CALIFORNIA

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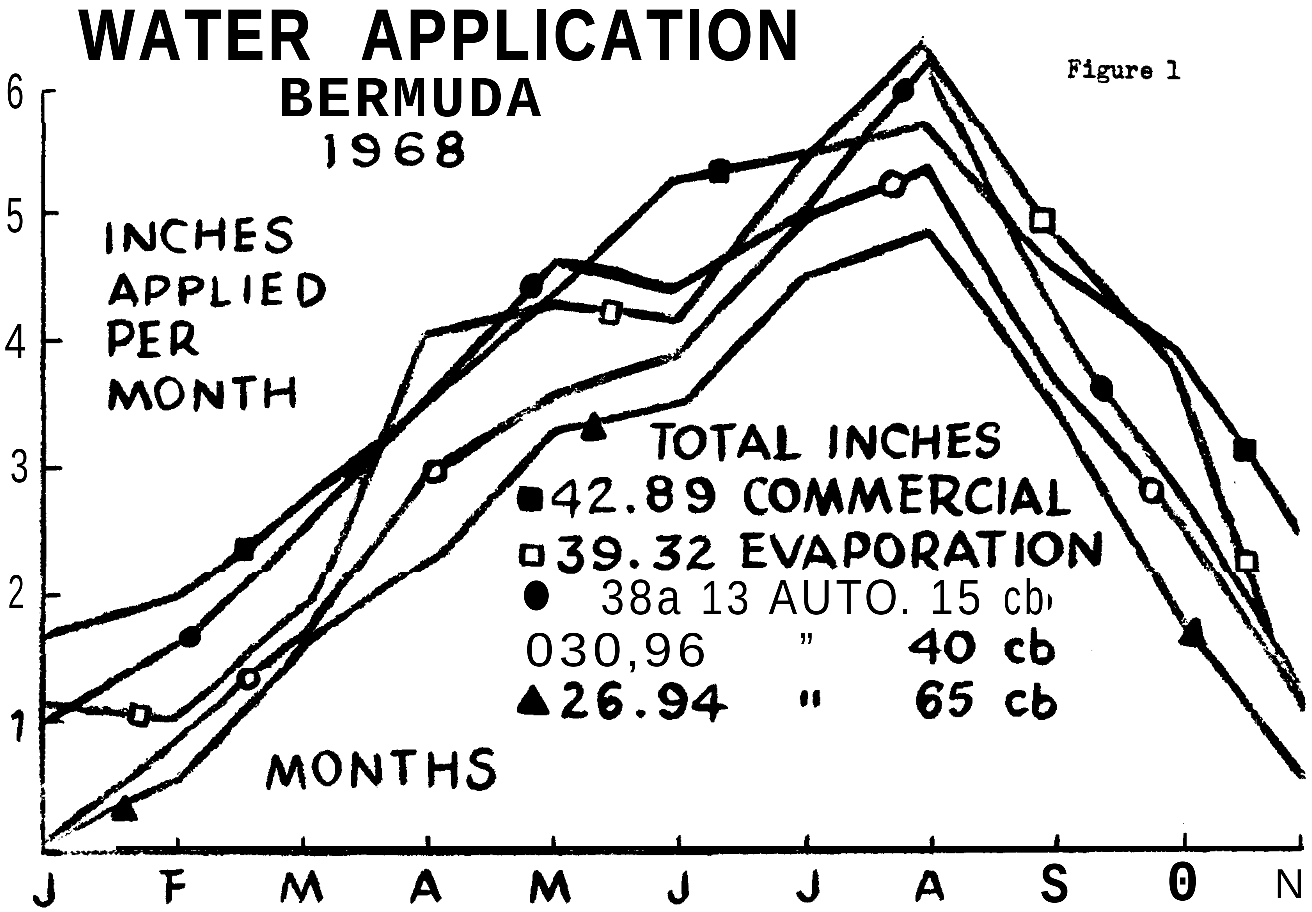
A turfgrass irrigation research program conducted by the University of California at the South Coast Field Station was started in 1966. The experiment consists of two turfgrass varieties having 5 irrigation treatments and 4 replications in a randomized block design.

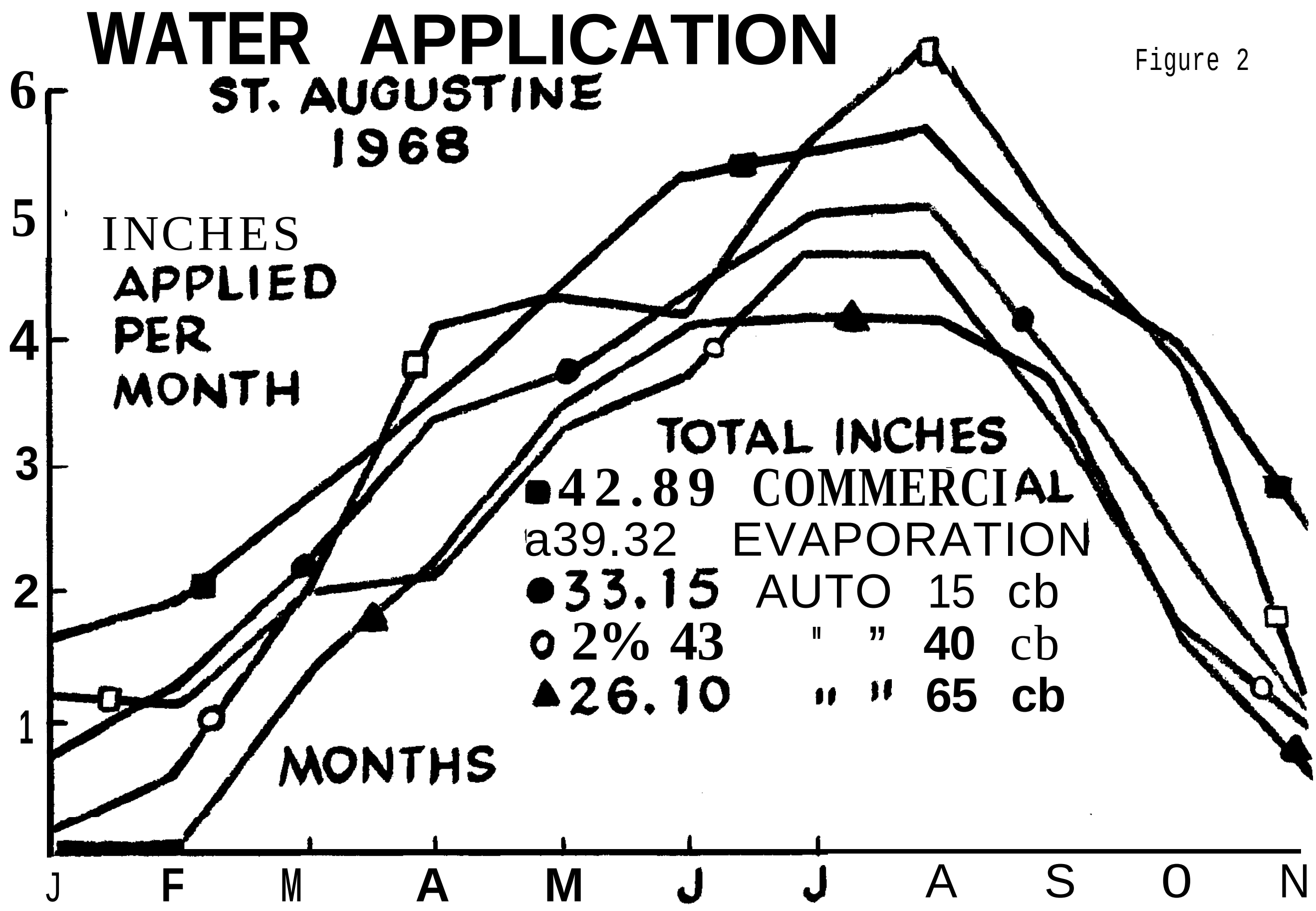
Table 1. IRRIGATION TREATMENTS

Label	Description
I-1	Automatic irrigation when a tensiometer at either 6" or 12" depth reaches 15 centibars (cb).
I-2	Automatic irrigation when a tensiometer at either 6" or 12" depth reaches 40 cb.
I-3	Automatic irrigation when a tensiometer at either 6" or 12" depth reaches 65 cb.
I-4	Manual irrigation based on evaporation measurements.
I-5	Manual irrigation to simulate that of local commercial turf managers.

'Table 1 summarizes the 5 irrigation treatments, all of which are activated through a controller. Individual plots in treatments I-l, I-2, and I-3 receive water automatically when either one of the tensiometers dries to the value describing the treatment. The controller is set to allow irrigations only at night and for repeated short cycles. Whenever enough cycles of irrigation have been applied to lower the tensiometer reading, the irrigation ceases. The reaction times of the 6-inch depth tensiometer is quick enough to terminate irrigation before all the soil is wet. The reaction time of the 12-inch depth tensiometer to irrigation is slower and permits enough extra irrigation periodically to rewet the profile to a deeper depth and even to accomplish some moderate leaching. In this manner the applied water comes very close to meeting the actual need. Time clocks record the exact number of minutes of irrigation to each individual plot so that the amount applied is accurately known.

Treatment I-4 is based upon daily measurements from a sunken evaporation pan. Irrigations are applied to this treatment whenever the measured evaporation totals about 1 inch. The amount of irrigation applied is 87% of the measured evaporation during the peak summer months





and 75% of the measured evaporation minus rainfall during the fall, winter and spring months. Treatment I-5 is considered as the check, whose timing and amount of irrigation are based upon a continuing assessment of the manner in which commercial turf managers in adjacent parts of Orange Co. are applying water. Treatments I-4 and I-5 are irrigated manually through the controller with all four replications in the treatment receiving water simultaneously.

The turfgrass has now been under this irrigation program for almost 3 years and will be terminated in 1969. Certain terminal measurements will be made and then the ground sterilized for planting of two new varieties in the fall of 1969. The new varieties will belong to the cool season group, whereas the present varieties have been classed as warm season grasses.

Figure 1 shows the water application by months and the tital for each treatment on the bermuda grass. Figure 2 shows the same information for the St. Augustine grass. Less water was applied with automatically controlled irrigations than it was with the manually controlled irrigations, even when considering the rather wet 15 cb treatment (I-l). The 40 cb level of irrigation, automatically controlled, provided a rather substantial saving in water compared to the commercial schedule. At no time was this treatment visibly different from the 15 cb treatment.

The curves show some rather interesting differences in water use among the treatments. The commercial schedule (Check plots I-5) received more water during the early and late spring and again in the fall than those treatments depending upon measurements related to actual water use, but received less water during the peak use season than some of the treatments based upon measured water use. A feature of southern California climate is a warming trend in the later winter-early spring months followed by a rather prolonged period of cool, overcast weather in the late spring-early summer months followed eventually by the hot weather of midsummer. The treatments based on measurements related to water use by the turf show this interseasonal effect with the rapid rise of water use in April and a flattening out in May and early June, but the commercial application rises steadily without any regard for this weather peculiarity.

For 1968, it has become apparent that the berrnuda grass in the I-l and I-2 treatments has used more water than the St. Augustine grass. This trend showed very slightly in 1967 but became more definite in hte 1968 data. There is no suitable explanation for this at present. Theoretically, both grasses should transpire the same amount of water.

In southern California it is generally feared that soil salinity may increase to a damaging level unless excess irrigation is applied periodically to leach or wash out the accumulated salts. Soil measurements made each fall before the rains when salt concentrations would be highest showed that there were no important concentrations of salts in any of the plots. The dry plots (I-3) had a slight but unimportant increase in salt concentration indicating that the automatic irrigation with its 2 depth control provided some degree of leaching.

VICTOR A. GIBEAULT IS NEW EXTENSION SERVICE TURFGRASS, LANDSCAPE SPECIALIST

Mr. Victor A. Gibeault has recently joined the California Agricultural Extension Service as a Turfgrass and Landscape Specialist. His responsibilities in this new position includes working with county farm advisors on turfgrass and landscape problems mainly in Southern California and broadening the flow of new research findings to turf/ornamental users.

Mr. Gibeault currently is completing the requirements for a Ph.D. degree at Oregon State University where he majored in turfgrass management. While at Oregon he taught a crop production course and acted as turf specialist in a position similar to his present one at UCR.

His B.S. and M.S. degrees were from the University of Rhode Island. Following his studies in Rhode Island, he spent a year at The Sports Turf Research Institute in Bengley, Yorkshire, England, where he worked on the control and understanding of annual bluegrass (Poa annua) in fine turf.

Mr. Gibeault will be officed with the Agronomy Department at UCR in Room 1145, Batchelor Hall.

NEW BOOK ON TURFGRASSES

TURFGRASS SCIENCE, Agronomy Monograph No. 14. Edited by A. A. Hanson and F. V. Juska, USDA, ARS. Published by the American Society of Agronomy.

This book of over 700 pages covers all aspects of turfgrasses and turfgrass management from basic discussions of physiology and ecology to maintenance of golf greens and athletic fields. Fertilization, irrigation, pest control and many other topics are given thorough coverage. The book consists of 28 chapters written by 38 authorities in the field of turfgrass management.

Turfgrass Science is the best reference published to date in this field. It should be in the library of every individual responsible for the maintenance of turf. It may be purchased from the American Society of Agronomy, 677 S. Segoe Road, Madison, Wisconsin, 53711. The cost is $10.00 to members of the Society and $12.50 to non-members.

TURFGRASS VARIETIES AND IRRIGATION PRACTICES

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The objective of turf cultural practices with specific reference to water management is to grow good quality turf with as efficient water utilization as possible. Unfortunately, water is often treated by turf managers as inexhaustible in supply and as a readily available panacea. Both are far from the truth as the need for water conservation is great and irrigation mismanagement leads to more turf ills than any other factor.

Modern turf culture, particularly in the Southwest, demands a thorough knowledge of characteristics and adaptations of turfgrass species as well as plant-soil-water relationships. Only by selecting the best adapted variety or species for a specific use and environment is maximum efficiency in water use with high turf quality possible.

Our interest, then, is in the turfgrass plant's ability to produce sufficient growth for the quality of turf desired with a minimum amount of water, a plant characteristic somewhat akin to drought resistance. Drought resistance may be considered to consist of two components, drought avoidance and drought tolerance (Levitt, 1964). In drought avoidance we have features of the plant which permits it to obtain water needed for growth and for replacement of that lost by transpiration even when soil water levels are low. Drought tolerance is the result of physiological and anatomical characteristics of the plant which permit it to survive but not necessarily grow during periods of low soil moisture.

Our interest in turf management, therefore, is primarily in the characteristics which permit the grass plant to avoid drought as these also lead to efficient water utilization. They may be found as features of both the leaves and roots of grasses.

Most plants have a protective coating of cutin or waxes on the leaf surfaces which provide a degree of protection from water loss through the epidermis. The heavier and more intact this wax layer or cuticle the better the pre vention of water loss. The responsiveness of stomata in closing as water stress develops is a major determining factor of the amount of water transpired duringperiods of high temperature, low humidity or wind. Leaf blades of many grasses roll as the plant is subjected to water stress, thus enclosing the upper surface. Since numerous stomata are located on the upper leaf surface, such rolling further aids in reducing water loss.

The fine, highly branched, and extensive root system of most grasses permit them to extract the available water in the top one to four feet of soil with great efficiency. The maximum depth to which water may be removed varies greatly with the species. Many fine roots of some species have been found at depths of six feet or more.

Turf cultural practices and soil conditions determine the extent to which a grass varieties rooting potential may be realized. Mowing, inadequate fertilization, excessive fertilization, poor watering practices, traffic, compacted soil, layered soil and shade, all restrict development of the grass root system. These factors may also reduce top growth but the effect on the root system is greater, producing a lower root:shoot ratio, a relationship of particular significance to efficient water utilization.

Crider (1955) showed that as clipping intensity (the portion of top growth removed at a single clipping) increased the larger were the number of roots which stopped growth and the longer the period of root growth-stoppage. If 40% or less of the top growth were removed at one time, root growth continued. However, as the amount removed approached 70-80%, all roots ceased growth and few, if any roots, resumed growth at any time. At such intense defoliations new roots which may develop appear from the plant crown or as branches from old roots just below the crown. Severe defoliation will also cause a degeneration of many old roots as well. Thus, the effect of close mowing is to produce a shallow root system and a poor root:shoot ratio.

As the root:shoot ratio becomes smaller the grass plant's ability to absorb the water needed to meet the demands of transpiration is lessened. Nitrogen fertilization stimulates growth of both shoot and root, but the increase in growth rate with increased nitrogen levels is greater for the shoot than for the root. Thus, as nitrogen fertility is increased the root-shoot ratio becomes smaller. As clipping is intensified because of the increased top growth, the root system is further restricted (Troughton, 1957).

Similar responses and interactions with clipping have been shown for decreasing light intensity (shading of turf) and for decreasing water tension (Brouwer, 1936).

Bermudagrasses are the best adapted and most drought tolerant of the turfgrasses for Southern California. Roots of the improved turf varieties have been traced to depths of over six feet even when mowed regularly and closely. The reason for this exceptional root system lies in part at least in their prostrate growth habit which permits much leaf surface to remain intact even when the turf is mowed at one-half inch. Quality turf, however, can be produced only if adequate moisture is maintained throughout the root zone.

Zoysiagrass also has a deep root system but, in general, it is shorter than that of bermuda. Zoysia will survive fairly long periods of drought but suffer severely from poor drainage and saturated soil. Water stress of Zoysia may be first detected in a rolling of the leaf blades.

Tall fescue is the best adapted cool-season grass for Southern California. The vigorous root system will penetrate tight compacted soil improving structure and water penetration. Tall fescue turf may survive a month or more without water and show no thinning or other permanent injury when watering is resumed.

Red fescues are moderately drought tolerant but do not have as deep a root system as the preceding species. The leaves are normally somewhat rolled and needle-like with the stomata set deeply between the ridges over the veins. This structure may contribute to a lower transpiration rate.

Kentucky bluegrasses must be mowed high, a minimum of 11/2 inches and preferably two inches or more, if an adequate root system is to be maintained.

Bentgrasses and annual bluegrasses have shallow root system and respond readily to high soil moisture. Annual bluegrass will grow on poor compacted soil if surface moisture is available.

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CALIFORNIA TURFGRASS CULTURE INDEX

Volume 1, Number 1; 1951 through Volume 19, Number 4, 1969

The California Turfgrass Culture, formerly Southern California Turfgrass Culture, has been in print for nineteen years and, during that time, a wealth of turfgrass literature has been presented. To aid with the classification of this material into a workable source of information, a subject matter index has been prepared by F. J. Nudge and V. A. Gibeault.

The twelve designated subject areas have been further divided into alphabetized subhaedings; each subheading contains the appropriate article(s), author(s) , volume, number and page. Cross references have been provided as needed.

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