UNIVERSITY OF CALIFORNIA, RIVERSIDE TURFGRASS RESEARCH PROGRAM

Better Turf Thru Agronomics

UCRTRAC Newsletter, June 1998

ET-based Irrigation Scheduling Saves Water and Money; UCR Research on Turf Plant Factors (K_c) Aids Budgeting

In a wet El Nino water year, it may not seem urgent to stay abreast of water conservation issues, but planners at the Metropolitan Water District of Southern California (MWD) predict future water supply in the region will fall short of demand in a dry year without increased conservation savings and development of new water resources (*Integrated Resources Plan*, MWD Report No. 1107).

Research at the University of California, Riverside (UCR) on turf plant factors (K_c) and reference evapotranspiration (ET_o) can conserve water use for landscape irrigation.

"An optimally efficient irrigation system coupled with frequent controller program updates based on K_c and local ET saves water resources, maintains turf quality, and reduces costs," said **Robert Green**, UCR Turfgrass Research Agronomist, and **Vic Gibeault**, UCR Environmental Horticulture Specialist.

ET-based irrigation scheduling can result in significant water and monetary savings for all urban water customers in the region -- turf managers at golf courses, sod farms, parks, and cemeteries; professional landscapers; and homeowners.

The goal is to irrigate turf as infrequently as possible at a recommended percentage of ET_o. ET_o data, which are readily available, are based on the estimated average water usage of a healthy 4- to 6-inch tall stand of cool-season grass. Historical ET_o for 16 cities in Southern California are reported in Table 1. Using ET_o, the real-time irrigation need of a turfgrass stand can be calculated according to equation (1):

$$\text{Irrigation water required} = (ET_o \times K_c)/DU = ET_{turf}/DU \quad (1)$$

where K_c is the turf plant factor (also known as the turf crop coefficient); DU is the distribution uniformity, a measure of how uniformly an irrigation system applies water to a crop surface; and ET_{turf} is the actual water used by the turf.

The K_c will vary, depending on whether the turf is cool- or warm-season and depending on the time of year (Table 2). In Southern California, the *annual* K_c for cool- and warm-season turf is 0.8 and 0.6, respectively (Table 2).

"Since it may not be practical to make monthly adjustments, the turfgrass coefficients (K_c) in Table 2 are also presented on a quarterly basis and can be used for monthly, quarterly, semi-annual, or annual irrigation programming or planning," said Green and Gibeault.

As DU decreases, more irrigation water will be required, although the actual water used by turf (ET_{turf}) is unchanged. ET_{turf}/DU determines the actual irrigation requirement.

Please see IRRIGATION RESEARCH, *page* 2

Green Kyllinga Is Becoming A Major Turf Weed in California

Green kyllinga *(Kyllinga brevifolia)* (Fig. 1) is a perennial, weedy sedge that is becoming a major problem in California turf from San Diego to the Sacramento valley, say UC weed scientists.

Although green kyllinga is most often a problem in bermudagrass swards, it also infests cool-season grasses. It grows best in full sun in moist areas during warm weather, from April through October, but it can survive some shade and drying, once established.

"Green kyllinga forms a weak sod that gives poor footing for athletic fields and golf courses. It grows faster that most turf cultivars and has a different color and texture, which means infested turf has an undulating, irregular surface as little as two days after mowing that significantly reduces the aesthetic quality of invaded turf, " said **Dave Cudney**, UCR Extension Weed Scientist.

This weed can spread rapidly once a few plants are established. In warm weather, rhizomes can expand more than one inch per day, growing into thick mats in a few weeks. Mowing and foot traffic can spread seed and rhizomes.

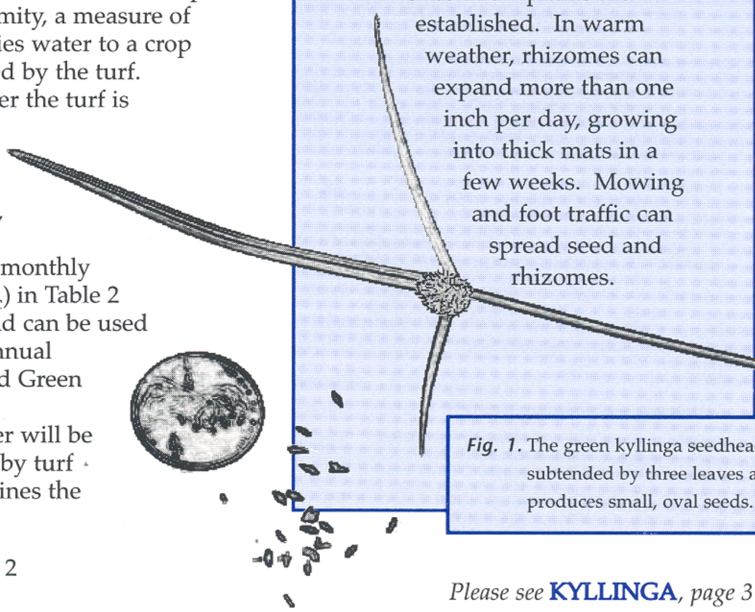


Fig. 1. The green kyllinga seedhead is subtended by three leaves and produces small, oval seeds.

Please see **KYLLINGA**, *page 3*

Table 1. Monthly Historical Reference Evapotranspiration (ET_o) in Inches Per Month for 16 Cities in Southern California

City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bakersfield	1.0	1.8	3.5	4.7	6.6	7.7	8.6	7.3	5.3	3.4	1.7	1.0
Barstow	2.6	3.6	5.7	7.9	10.1	11.6	12.0	10.4	8.6	5.7	3.3	2.1
Beaumont	2.0	2.3	3.4	4.4	6.1	7.1	7.6	7.9	6.0	3.9	2.6	1.7
El Centro	2.7	3.6	5.6	7.9	10.1	11.1	11.6	9.5	8.3	6.1	3.3	2.0
Escondido	2.1	2.8	3.8	4.7	5.5	6.1	6.7	6.5	5.4	3.8	2.5	2.0
Fallbrook	2.1	2.7	3.8	4.7	5.5	6.1	6.8	6.5	5.4	3.8	2.5	2.0
Long Beach	2.2	2.7	3.4	3.8	4.6	4.6	4.9	4.9	4.4	3.4	2.4	2.0
Los Angeles	2.2	2.7	3.7	4.7	5.5	5.8	6.2	5.9	5.0	4.0	2.6	2.0
Palm Springs	2.0	3.9	4.9	7.2	8.3	8.5	11.6	8.3	7.2	5.9	2.7	1.7
Pasadena	2.1	2.7	3.7	4.7	5.1	6.0	7.1	6.7	5.6	4.2	2.6	2.0
Riverside	2.1	2.9	4.0	4.1	6.1	7.1	7.9	7.6	6.1	4.2	2.6	2.0
San Bernardino	2.0	2.7	3.8	4.6	5.7	6.9	7.9	7.4	5.9	4.2	2.6	2.0
San Diego	2.2	2.7	3.4	3.8	4.9	4.9	5.1	4.9	4.5	3.4	2.4	2.0
Santa Ana	2.2	2.7	3.7	4.5	4.6	5.4	6.2	6.1	4.7	3.7	2.5	2.0
29 Palms	2.6	3.6	5.9	7.9	10.1	11.2	11.2	10.3	8.6	5.9	3.4	2.2
Victorville	2.3	3.1	4.9	6.7	9.3	10.0	11.2	9.8	7.4	5.1	2.8	1.9

Many turfgrass sites have an irrigation DU ranging from 50 to 70 percent, with more water and dollar savings being realized as the DU increases.

Regardless of how much irrigation water is applied, it must reach the root zone to be available for plant uptake. If the precipitation rate is greater than the soil infiltration rate, runoff will occur.

Therefore, one should determine how long sprinklers can run before water begins to pool and run off and then set irrigation run times shorter than this time period. Based on the inches of irrigation water to be applied, as computed by equation (1), several sequential irrigation "cycles" may be needed to apply enough water to meet plant needs. Some irrigation controllers offer cycle repeat features, precluding the need for multiple start times, said Green and Gibeault.

Methods for calculating run times and recommendations for improving system uniformity -- checking and adjusting operating pressures, selecting appropriate heads and nozzles, checking head alignment and operation, and irrigating at times when wind is minimal -- are discussed in detail with practical examples in *California Turfgrass Culture*, Vol. 47(3&4), 1997 in a semi-technical article, "Using ET_o (Reference Evapotranspiration) for Turfgrass Irrigation Efficiency," by William Richie, UCR staff research associate, and Green and Gibeault.

Table 2. Cool- and Warm-Season Turf Crop Coefficients (K_c) in Southern California

Cool-Season Turfgrass					Warm-Season Turfgrass				
Month	Monthly	Quarterly	SemiA[a]	Annually	Month	Monthly	Quarterly	SemiA[a]	Annually
Jan.	.61				Jan.	.55			
Feb.	.64	.67	.68		Feb.	.54	.62	.55	
March	.75				March	.76			
April	1.04				April	.72			
May	.95	.96			May	.79	.73		
June	.88		.90	.80	June	.68		.71	.60
July	.94				July	.71			
Aug.	.86	.85			Aug.	.71	.68		
Sept.	.74				Sept.	.62			
Oct.	.75				Oct.	.54			
Nov.	.69	.68	.68		Nov.	.58	.56	.55	
Dec.	.60				Dec.	.55			

[a]SemiA = semi-annually

KYLLINGA *continued from page 1*

Only recently has kyllinga become a serious problem for turf managers in California, but its presence was reported here as long as 50 years ago, Cudney said.

The *Kyllinga* genus, believed to have originated in Asia, consists of about 40 species distributed worldwide in subtropical and warm temperate regions.

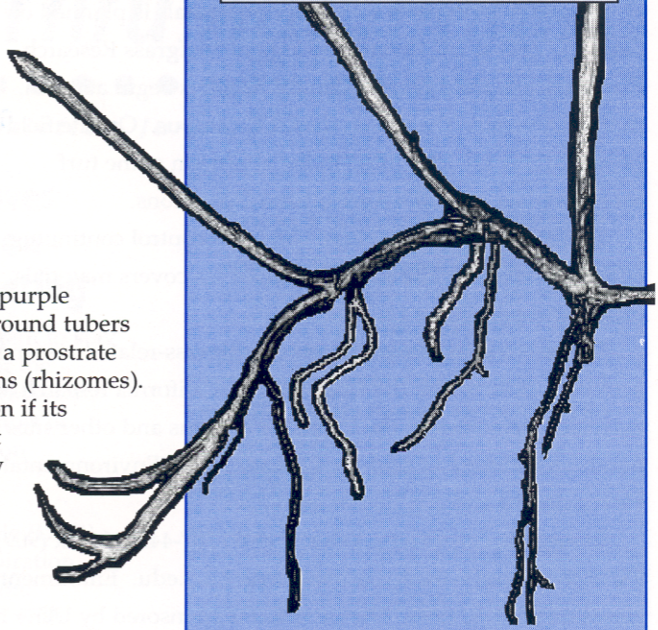
Kyllinga Identification and Life Cycle

Green kyllinga is often confused with yellow or purple nutsedge, but its flower and the absence of underground tubers (nutlets) make it distinguishable. Green kyllinga is a prostrate plant that produces a network of underground stems (rhizomes). New plants can arise from each node or stem section if its rhizomes are removed and chopped into pieces. At each stem node, it roots and sends out long, narrow leaves, ranging from one to more than 5 inches in length (Fig. 2).

The triangular flowering stalks, which are generally 2 to 8 inches in length, terminate in a green-colored, globular inflorescence about 1/4 inch in diameter, which is subtended by a group of three leaves that radiate out from immediately below (Fig. 3). Within each inflorescence are 30 to 75 spikelets, each capable of producing one seed. Mature seed heads yield about 30 to 75 seeds each. Seeds are oval, flat in cross section, and quite small (1/8 inch long and 1/16 inch wide).

In contrast to yellow and purple nutsedge, green kyllinga seed is highly viable. A mature plant produces more than 100 seed heads in a growing season with more than 5,000 seeds, on average. Seed germination occurs at or very near the soil surface and is favored by adequate soil moisture and temperatures about 65ºF. Germination can continue throughout the summer. Burying seed as little as 1/2 inch in the soil reduced germination by 12-fold in one study.

Fig. 2. Rooting can occur at each node along green kyllinga's network of rhizomes.



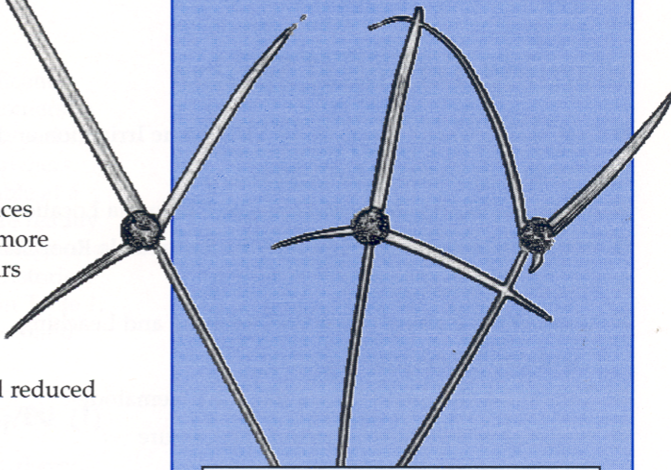


Fig. 3. **Triangular flowering stalks are shown. The long, narrow leaves of green kyllinga range from one to five inches in length.**

Kyllinga Management in Turf

The primary control method is prevention. When solitary weed infestations are found, early grubbing is successful if the area is monitored for several months to make sure that removal is complete. Spot spraying isolated weeds with glyphosate will kill green kyllinga, but the turf will die also, leaving open areas making weed reestablishment easier, unless the open spots are overseeded to favor a vigorous turf. Keep turf well-maintained to assure maximum vigor and competitiveness and to deter weed invasion. Dense turf shades soil surfaces, making establishment of kyllinga seedlings difficult.

Green kyllinga can survive mowing heights of 1/2 inch, often flowering and producing new seed at that mowing height. Clean mowers and renovation equipment to avoid spread.

Preemergence herbicides (pendimethalin, prodiamine, bensulide, and benelin) have been successful in limiting germination of green kyllinga seeds. These herbicides could be applied in April to limit germination in late spring and early summer.Postemergence herbicides can limit growth of green kyllinga. The best control has been obtained when 2 applications of halosulfuron are spaced about 2 weeks apart. Multiple applications of MSMA will reduce infestations. At least 3 applications at 7 to 10 day intervals are needed. Bentazon reduces green kyllinga growth when 2 applications are made about 2 weeks apart.

To learn more about green kyllinga, consult UC's ***Pest Notes Series*** on the World Wide Web at http://www.ipm.ucdavis.edu.

Turfgrass Research Conference and Field Day -- Sept. 15, 1998

A full day of updates for turf professionals is planned on Sept. 15, 1998 at UC Riverside's annual Turfgrass Research Conference & Field Day. Technical sessions begin at 8 a.m. in the University Theatre on the UCR campus. On-site field presentations are scheduled in the afternoon at the turf research plots at UCR's Agricultural Operations.

Conference participants can earn pest control continuing education credits. The $35 registration fee covers materials, lunch, and parking at UCR.

"There is a significant amount of turfgrass-related research activity conducted by the University of California research and extension personnel at the Riverside campus and other sites in Southern California," said Vic Gibeault, UCR Environmental Horticulturist and conference organizer.

To register, call Susana Velez at (909) 787-4430; fax at (909) 787-5717; or use e-mail: susana@ucrac1.ucr.edu. Enrollment closes on Sept. 9, 1998. The program is sponsored by UC Cooperative Extension, UCR's Botany and Plant Sciences Department, and UCR Agricultural Operations.

Morning Technical Session

- Best Management Practices for Tall Fescue Irrigation and Nutrition in Southern California
- Bentgrass Variety Trials at Three So. California Locations
- What Happened to the Grass in the Retractable Roof Stadium?
- Fate of Pesticides in Turf
- Maintaining Putting Green Soil Aeration and Leaching Capability During the Summer
- Unraveling the Secret Life of the Sting Nematode
- Sustainable Turfgrass Selection and Culture

Afternoon Field Session

- Tall Fescue Irrigation and Nutrition Field Study
- Sports Turf Under Limited Light
- Irrigation Management for Mixed Landscapes
- Seasonal Influence on Zoysiagrass Stolonization
- Kyllinga Identification and Management
- Effects of Organic Matter Topdressing on Kentucky Bluegrass

New Delegates Appointed to UCRTRAC

Three new delegates have been appointed to the Turfgrass Research Advisory Committee at the University of California, Riverside, known as UCRTRAC. UCRTRAC addresses the research and educational needs of the Southern California turfgrass industries.

David Michael was appointed recently to serve with **Bert Spivey**, a delegate since the inception of UCRTRAC, to represent the Golf Course Superintendents Association (GCSA) of Southern California. **Bill Kostes** and **Cary Lee** are new delegates representing the Hi-Lo Desert GCSA.

Continuing as delegates are **Kevin Heaney** and **John Martinez**, representing the Southern California Golf Association; **Tracy Barcelona** and **John Pollok**, representing the California GCSA; **Alan Andreasen** and **Tim Barrier**, representing the San Diego GCSA; **Jurgen Gramckow**, representing the California Sod Producers Association; **Tom Gustafson** and **Scott Walter**, representing the Southern California Section, Professional Golfers Association; **Fred Eckert** and **Mark Hodnick**, representing the Southern California Turfgrass Council; **Neal Beeson** and **Chuck Wilson**, representing the Southern California Turfgrass Foundation; and **Pat Gross**, representing the United States Golf Association.

Members representing UCR are **Vic Gibeault**, Cooperative Extension Environmental Horticulture Specialist, **Robert Green**, Turfgrass Research Agronomist, and **Steve Cockerham**, Superintendent, Agricultural Operations.

Better Turf Thru Agronomics is prepared for the delegates and membership of the University of California, Riverside Turfgrass Research Advisory Committee (UCRTRAC). Member organizations are the Southern California Golf Association; California Golf Course Superintendents Association (GCSA); GCSA of Southern California; San Diego GCSA; Hi-Lo Desert GCSA; California Sod Producers Association; Southern California Section, Professional Golfers Association; Southern California Turfgrass Council; Southern California Turfgrass Foundation; United States Golf Association; and UCR. The intent is to present summaries of turfgrass research results and topical information of interest to the Southern California turfgrass industries. The newsletter is written by Deborah Silva and edited by Dr. Vic Gibeault and Dr. Robert Green and designed by Jack Van Hise, UCR Printing and Reprographics.