A PRACTICAL RESEARCH DIGEST FOR TURF MANAGERS

TURFGRASS TRENDS

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PLANT HEALTH

Basic Plant Management Techniques — Part 1

Best management practices reduce organic materials in landscape plantings. This section looks at two turf irrigation options.

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Following proper management practices can significantly reduce the production of organic materials in landscape plantings. Implementing recommended irrigation, fertilization, and other cultural practices can reduce the vegetative growth of turfgrass and woody plants without sacrificing aesthetic appeal or performance. Employing the techniques described in this publication will enable landscape managers to achieve both of these goals.

Turfgrass irrigation management

Proper turfgrass irrigation management is important to optimize plant health and to reduce unnecessary production of organic matter. Scheduling irrigation based on water requirements of the turfgrass is one of the most important management practices available to promote healthy and attractive turfgrass plantings able to withstand traffic and other stresses. Irrigation scheduling involves applying the right amount of water over the correct amount of time, based on the evapotranspiration (ET) rate of the plant. (Evapotranspiration is the combined water loss from the soil surface and through the plant.)

Too much water can result in diseased turfgrass and unsafe, flooded parks and playing fields, while too little water can lead to a thin stand of poorly growing turfgrass with low vigor, poor recuperative ability and appearance and unsafe playing conditions for sports such as soccer and football.

There are two effective methods of scheduling turfgrass irrigation. While both methods result in effective irrigation and minimal water waste, *Method One* is especially targeted to those with limited time and resources who are interested in increasing turfgrass quality while decreasing an overabundance of clippings that make grasscycling difficult.

Method Two is targeted toward personnel with greater time and resources who are interested in fine-tuning their irrigation scheduling practices to an even greater extent and is based on results of a more precise 'can test' than Method One. It offers the option of using real-time reference evapotranspiration (ETo) information available through the California Irrigation Management Information System (CIMIS), discusses the use of tensiometers, and describes how to mathematically determine the distribution uniformity (DU), application

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While both methods result in effective irrigation and minimal water waste, Method One is especially targeted to those with limited time and resources who are interested in increasing turfgrass quality while decreasing an overabundance of clippings that make grasscycling difficult.

rate, net amount of water to apply, and sprinkler run times.

Method One will provide a close approximation of irrigation requirement when climatic conditions are near average. During an unusual weather pattern that persists for an extended period, Method One may not accurately predict ET, and the turfgrass should be monitored closely for signs of too much or too little water, with necessary corrections made.

How Method One works

This method of irrigation scheduling uses average (historical) ETo recorded over several years to estimate ET of warm and cool season turfgrasses on a weekly basis. Table 1 (Minutes to Irrigate Warm and Cool Season Turfgrasses per Week) was computed from these data. ETo is an estimate of the amount of water used by healthy 4- to 6-in. cool-season turfgrass. Table 1 reflects the fact that research indicates that warm season turfgrass require about 20 percent less water than cool-season turfgrass.

■ 1. Determine the sprinkler system precipitation rate. Set a minimum of six straight-sided cans of the same type (any straight-sided cans may be used or they can be purchased from a variety of grocery store suppliers) between sprinkler heads receiving water from the same valve. If possible, space cans on 10 or 15-foot centers for more accurate results. Run the sprinklers for 15 minutes and measure the depth of water in each can with a ruler; record each depth on a corresponding grid for future reference that indicates the field location of each of the cans.

Determine the average depth of water in

TABLE 1.

Minutes to Irrigate Warm and Cool Season Turfgrass per Week
NORTHEASTERN MOUNTAIN VALLEYS

Warm Season Turfgrasses: Not recommended	Cool Season Turfgrasses: Minutes to irrigate/week if hourly sprinkler output is:			
	0.5 in	1.0 in	1.5 in	2.0 in
JAN	17	08	06	04
FEB	34	17	11	08
MAR	59	29	20	15
APR	101	50	34	25
MAY	134	67	45	34
JUN	168	84	56	42
JUL	210	105	70	53
AUG	176	88	59	44
SEP	126	63	42	32
OCT	76	38	25	19
NOV	25	13	09	06
DEC	17	09	06	04

each can and multiply this number by four to determine the sprinkler output in inches per hour (precipitation rate).

If possible, conduct the 'can test' at the same time of day the turfgrass is ordinarily watered since water pressure often varies over a 24-hour period. Also, avoid conducting the test during an unusually windy period.

■ 2. Determine the length of time to irrigate the turfgrass. Use the appropriate geographical area in Table 1 that most closely matches the location of the turfgrass planting to be irrigated. Use the precipitation rate in the corresponding table that comes closest to, but does not exceed, the output rate determined in 1.

Controllers should be reset at least monthly during the summer and at least quarterly the rest of the year to match seasonal changes in irrigation requirements.

The columns of numbers in Table 1 indicate the total number of minutes to irrigate over a one-week period. Divide the total minutes into two, three, or four irrigations per week, depending on how many minutes a single irrigation can run before runoff starts.

Irrigation cycling is recommended on slopes and soils that do not absorb water quickly. This entails irrigating to the point that runoff starts, waiting 10 or 15 minutes, and irrigating a second time, and, sometimes, a third time, until the required amount of water for that particular day has been applied. Turfgrass benefits from drying down somewhat between irrigations, to encourage deep rooting.

In general, turfgrass should not be irrigated more often than four times a week, with the exception of some golf course putting greens. Controllers should be reset at least monthly during the summer and at least quarterly the rest of the year to match seasonal changes in irrigation requirements, based on Table 1.

The Extension service has recommendations for most major regions in the state. If your area is not here, contact the authors for specifics.

How Method Two works

This method of irrigation scheduling relies on results of a more precise 'can' test than Method 1, offers the option of using real-time ETo information available through the California Irrigation Management Information System (CIMIS), discusses the use of tensiometers and describes how to mathematically determine distribution uniformity (DU), application rate, net amount of water to apply, and sprinkler run times:

■ 1. Use either real-time or historical records to estimate reference evapotranspiration (ETo). ETo is an estimate of the amount of water used by healthy 4- to 6-in. tall cool-season turfgrass.

Real-time ETo is based on measurements of current environmental conditions that determine plant water use, as opposed to average conditions for a certain time of year, used in Method 1. These measurements include solar radiation, air temperature, wind speed, and relative humidity.

The California Irrigation Management Information System (CIMIS), managed by the California Department of Water Resources, provides real-time ETo data at several locations in Southern California. Turfgrass plantings in areas of close proximity to these locations have similar ETo requirements.

Real-time ETo from CIMIS can be downloaded on microcomputers. For more information on CIMIS, contact the California Department of Water Resources at 800/92-CIMIS.

■ 2. Assign an appropriate percentage of ETo to the turfgrass to be irrigated. Warm-season turfgrasses (bermudagrass, zoysiagrass, St. Augustinegrass) require about 20 percent less water than cool-season turfgrasses (tall fescue, annual and perennial ryegrass, bluegrass), and should be irrigated at 60 percent of ETo, while cool season tur-

Turfgrass plantings in areas close to locations in southern California have similar ETo requirements. Real-time ETo from CIMIS can be downloaded on microcomputers.

fgrasses require at least 80 percent of ETo to maintain optimum quality.

Example. In July, a bermudagrass park located in San Bernardino has the following water requirements for optimal growth in an average year:

6.82 Inches x .6 = 4.1 Inches

Table 2 indicates that historical ETo in July in San Bernardino (Southern Inland Valleys) totals 6.82 inches. Multiplying 6.82 times the suggested percent ETo for warm season turfgrass (.6) indicates the water requirement for July to be 4.1 inches.

■ 3. Determine an acceptable allowable soil-moisture depletion rate. Knowing when to irrigate is as important as knowing how much irrigation water to apply. While it is important to let turfgrass dry down some between irrigations, it is also important to apply water before significant symptoms of drought stress occur.

Tensiometers and other soil moisture measuring devices can be very helpful in determining maximum allowable soil-moisture depletion. During the summer, a tensiometer reading of 60 centibars at a six-inch to one foot soil depth approaches the maximum allowable soil-moisture depletion for warm-season turfgrass.

A reading of 40 centibars at a 4-in. depth identifies the maximum allowable depletion for cool-season grass. (Remember that the higher the centibar reading, the drier the soil.)

■ 4. Determine the distribution uniformity (DU) of the irrigation system. The easiest and most accurate method to determine the distribution uniformity (DU) of a sprinkler system is to conduct a 'can test'. A major goal of irrigating turfgrass is to obtain the highest DU possible to provide optimum conditions for turfgrass growth throughout the planted area and to reduce water waste.

Straight-sided cans are useful for conducting 'can tests' since water collected during the sample run can easily be measured with a ruler. Alternatively, cans without straight sides may be used, although volumetric measurements are then required.

After laying out the cans to perform the

TABLE 2.

Average Monthly Reference Evapotranspiration (ETo) Rates Throughout California

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NE Mountain Valleys	0.62	1.16	2.17	3.60	4.96	5.70	8.06	7.13	4.80	2.79	0.90	0.62
Northern Coast	0.62	1.16	1.86	2.40	3.41	3.60	3.41	3.41	2.70	1.86	1.20	0.62
Northern Inland Valleys	0.93	1.16	2.48	3.30	4.96	6.00	7.13	6.20	4.50	2.79	1.20	0.62
Sacramento Valleys	1.24	1.74	3.10	4.50	5.89	7.20	8.06	6.82	5.10	3.41	1.80	0.93
San Joaquin Valleys	0.93	1.74	3.10	4.50	6.51	7.50	7.75	6.51	4.80	3.41	1.50	0.62
Central Coast	1.86	2.32	3.10	3.90	4.65	4.80	5.27	4.96	3.90	3.10	2.10	1.55
Central Inland Valleys	1.55	2.32	3.41	4.20	5.58	6.30	6.82	5.89	4.80	3.72	2.40	1.55
Sierra (Tahoe Basin)	—	—	—	3.00	4.03	4.80	6.20	5.27	3.00	2.79	—	—
Southern Coast	1.86	2.61	3.10	3.90	4.34	5.10	5.58	5.58	4.50	3.41	2.70	2.10
Southern Inland Valleys	1.86	2.61	3.41	4.20	4.96	6.00	6.82	6.82	5.10	3.72	2.40	1.80
Southern CA Deserts	2.79	3.77	5.89	7.50	10.23	11.40	11.47	9.61	8.40	6.20	3.60	1.86

'can test' in either 10- or 15-ft. centers, operate the sprinkler system for 15 minutes.

Then, measure and record the amount of water in each can on a site map. Determine the average (mean) amount of water per can.

Next, calculate the average amount of water that accumulated in the 'low quarter'. For example, if there were 100 total cans in the test, the overall mean average of water in all the cans should be determined first. Then, the average amount of water in the 25 cans that accumulated the least amount of water (the 'low quarter') is calculated and recorded.

The DU can then be determined using the following formula:

Distribution Uniformity (DU) = Mean of the Low Quarter x 100

Overall Mean

■ 5. Determine the amount of irrigation water to apply. Divide the monthly percent ETo used in 2 by the DU calculated in 4.

■ 6. Determine the hourly sprinkler system application rate. Multiply the average amount of water per can from the 'can test' (4) by four, since the system ran for 15 minutes.

■ 7. Determine the sprinkler run time. The sprinkler run time is the net amount of water to apply (determined in 5) divided by the sprinkler system application rate (determined in 6). This number multiplied by 60 equals the run times in minutes.

Example: If 0.50 inches of water needs to be applied during each irrigation and the application rate is 1.0 inch/hour, the run time equals 0.50 hours or 30 minutes:

0.50/1.0 = 0.50 hours,
and 0.50 x 60 = 30 minutes

Other considerations

It is important to maintain a high DU so irrigation water is evenly applied to the turfgrass area being irrigated to avoid unnecessary water waste. Table 1 assumes an 80 percent DU. A system with a DU of 40 percent requires twice as much water as a system with a DU of 80 percent!

Even with limited resources, conducting regular 'can' tests is a sound investment, and often leads to substantial savings of water and money, unnecessary greenwaste production and a healthier turfgrass planting less prone to pests.

Runoff is an excellent indicator of how long an irrigation cycle may run. Simply measure the length of time it takes for runoff to begin from the time the system turns on. This is the maximum run time per irrigation.

Runoff is an excellent indicator of how long an irrigation cycle may run. Simply measure the length of time it takes for runoff to begin from the time the system turns on.

If necessary, irrigations may be cycled by adding smaller amounts of water during each irrigation to allow the water to soak into the soil before adding more water. It is important that the cycles are repeated over a short period of time, before the soil dries significantly. Several cycles may be required.

Scheduling irrigations around sports field usage and golf rounds without sacrificing turfgrass quality or field safety is an important consideration for many turfgrass professionals. Early morning irrigation is preferred.

Irrigation should occur long enough before play to avoid wet conditions during games, since wet soils compact easily, leading to stressed plants and poor playing conditions.

Scheduling regular walk-throughs to identify and correct problems with irrigation equipment on-site is as important to the overall health and function of the turfgrass planting as is irrigation scheduling.

When an irrigation system is inoperative for even a day or two under high summer temperatures, drought stress can lead to temporary damage to the turfgrass. In many cases, substantial amounts of water

CALIFORNIA COASTAL IRRIGATION REQUIREMENTS

Table 1. NORTHERN COAST

Warm Season Turfgrasses: Minutes to irrigate/week if hourly sprinkler output is:

Cool Season Turfgrasses: Minutes to irrigate/week if hourly sprinkler output is:

	Warm Season		Cool 0.5 in	Cool 1.0 in	Cool 1.5 in	Cool 2.0 in
JAN	NOT RECOMMENDED	JAN	15	07	05	04
FEB	NOT RECOMMENDED	FEB	36	18	12	09
MAR	NOT RECOMMENDED	MAR	55	27	18	14
APR	NOT RECOMMENDED	APR	67	34	22	17
MAY	NOT RECOMMENDED	MAY	88	44	29	22
JUN	NOT RECOMMENDED	JUN	97	48	32	24
JUL	NOT RECOMMENDED	JUL	95	47	32	24
AUG	NOT RECOMMENDED	AUG	90	45	30	23
SEP	NOT RECOMMENDED	SEP	76	38	25	19
OCT	NOT RECOMMENDED	OCT	48	24	16	12
NOV	NOT RECOMMENDED	NOV	32	16	11	08
DEC	NOT RECOMMENDED	DEC	21	11	07	05

Table 2. CENTRAL COAST

Warm Season Turfgrasses Minutes to irrigate/week if hourly sprinkler output is:

Cool Season Turfgrasses Minutes to irrigate/week if hourly sprinkler output is:

	Warm 0.5 in	Warm 1.0 in	Warm 1.5 in	Warm 2.0 in		Cool 0.5 in	Cool 1.0 in	Cool 1.5 in	Cool 2.0 in
JAN	38	19	13	09	JAN	50	25	17	13
FEB	50	25	17	13	FEB	67	34	22	17
MAR	63	32	21	16	MAR	84	42	28	21
APR	88	44	29	22	APR	118	59	39	29
MAY	101	50	34	25	MAY	134	67	45	34
JUN	113	57	38	28	JUN	151	76	50	38
JUL	95	47	32	24	JUL	126	63	42	32
AUG	113	57	38	28	AUG	151	76	50	38
SEP	95	47	32	24	SEP	126	63	42	32
OCT	69	35	23	17	OCT	92	46	31	23
NOV	50	25	17	13	NOV	67	34	22	17
DEC	38	19	13	09	DEC	50	25	17	13

Table 3. SOUTHERN COAST

Warm Season Turfgrasses Minutes to irrigate/week if hourly sprinkler output is:

Cool Season Turfgrasses Minutes to irrigate/week if hourly sprinkler output is:

	Warm 0.5 in	Warm 1.0 in	Warm 1.5 in	Warm 2.0 in		Cool 0.5 in	Cool 1.0 in	Cool 1.5 in	Cool 2.0 in
JAN	44	22	15	11	JAN	59	29	20	15
FEB	57	28	19	14	FEB	76	38	25	19
MAR	63	32	21	16	MAR	84	42	28	21
APR	76	38	25	19	APR	101	50	34	25
MAY	88	44	29	22	MAY	118	59	39	29
JUN	95	47	32	24	JUN	26	63	42	32
JUL	107	54	36	27	JUL	143	71	48	36
AUG	95	47	33	24	AUG	126	63	42	32
SEP	82	41	27	20	SEP	109	55	36	27
OCT	69	35	23	17	OCT	92	46	31	23
NOV	50	25	17	13	NOV	67	34	22	17
DEC	38	19	13	9	DEC	50	25	17	13

CALIFORNIA INLAND VALLEY IRRIGATION REQUIREMENTS

Table 4. SACRAMENTO VALLEYS

Warm Season Turfgrasses

Minutes to irrigate/week if hourly sprinkler output is:

	0.5 in	1.0 in	1.5 in	2.0 in
JAN	19	09	06	05
FEB	44	22	15	11
MAR	69	35	23	17
APR	101	50	34	25
MAY	126	63	42	32
JUN	158	79	53	39
JUL	164	82	55	41
AUG	145	72	48	36
SEP	113	57	38	28
OCT	82	41	27	20
NOV	38	19	13	09
DEC	19	09	06	05

Cool Season Turfgrasses

Minutes to irrigate/week if hourly sprinkler output is:

	0.5 in	1.0 in	1.5 in	2.0 in
JAN	25	13	08	06
FEB	59	29	20	15
MAR	92	46	31	23
APR	134	67	45	34
MAY	168	84	56	42
JUN	210	105	70	53
JUL	218	109	73	55
AUG	193	97	64	48
SEP	151	76	50	38
OCT	109	55	36	27
NOV	50	25	17	13
DEC	25	13	08	06

Table 5. SAN JOAQUIN VALLEYS

Warm Season Turfgrasses

Minutes to irrigate/week if hourly sprinkler output is:

	0.5 in	1.0 in	1.5 in	2.0 in
JAN	19	09	06	05
FEB	38	19	13	09
MAR	69	35	23	17
APR	101	50	34	25
MAY	132	66	44	33
JUN	164	82	55	41
JUL	170	85	57	43
AUG	145	72	48	36
SEP	113	57	38	28
OCT	69	35	23	17
NOV	32	16	11	08
DEC	13	06	04	03

Cool Season Turfgrasses

Minutes to irrigate/week if hourly sprinkler output is:

	0.5 in	1.0 in	1.5 in	2.0 in
JAN	25	13	08	06
FEB	50	25	17	13
MAR	92	46	31	23
APR	134	67	45	34
MAY	176	88	59	44
JUN	218	109	73	55
JUL	227	113	76	57
AUG	193	97	64	48
SEP	151	76	50	38
OCT	92	46	31	23
NOV	42	21	14	11
DEC	17	08	06	04

Table 6. SOUTHERN INLAND VALLEYS

Warm Season Turfgrasses

Minutes to irrigate/week if hourly sprinkler output is:

	0.5 in	1.0 in	1.5 in	2.0 in
JAN	52	21	14	10
FEB	57	28	19	14
MAR	80	40	27	20
APR	96	48	32	24
MAY	119	60	40	29
JUN	144	72	48	36
JUL	165	83	55	41
AUG	155	77	52	39
SEP	124	62	41	31
OCT	88	44	29	22
NOV	54	27	18	14
DEC	42	21	14	10

Cool Season Turfgrasses

Minutes to irrigate/week if hourly sprinkler output is:

	0.5 in	1.0 in	1.5 in	2.0 in
JAN	56	28	19	14
FEB	75	38	25	19
MAR	106	53	35	27
APR	128	64	43	32
MAY	159	80	53	40
JUN	193	96	64	48
JUL	221	110	74	55
AUG	207	103	69	52
SEP	165	82	55	42
OCT	117	59	39	29
NOV	73	36	24	18
DEC	55	28	19	14

loss due to a low DU can be avoided by checking equipment regularly.

One of the most important steps to take to avoid low DU's leading to brown spots and wasted water is to maintain a well-stocked inventory of matched irrigation components for emergencies.

Additionally, parts such as piping, repair couplings, isolation valves, electric valves and other components should be readily available. It is wise to have at least one person knowledgeable in irrigation equipment and scheduling who can monitor irrigation functions regularly.

Sprinklers should be regularly checked for the following common causes of poor distribution uniformity and necessary repairs made as soon as possible: broken sprinklers; unmatched sprinklers; sunken sprinklers; crooked sprinklers; turfgrass growing around sprinklers; and, sand or debris plugging sprinklers.

Editors' note: Next month, Part 2 will review basic methods to reduce materials in landscape tree irrigation, pruning and fertilization.

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REFERENCES

Beard, J.B. 1973. Turfgrass Science and Culture. Prentice, Hall, Englewood Cliffs, N.J.

California Environmental Protection Agency, Integrated Waste Management Board. 1996. Grasscycling: Send Your Grass Back to its Roots: Publication #500-94-007.

Harivandi, A. and V.A. Gibeault. 1999. Mowing Your Lawn and Grasscycling. UC DANR Leaflet 2587.

Harris, R. A., J..R. Clark, and N .P. Matheny. Arboriculture: Integrated Management of Landscape Trees, Shrubs, and Vines. 3rd edition. 1998. Prentice-Hall, Englewood Cliffs, N.J.

Hartin, J.S., V.A. Gibeault and J.L. Meyer. 1995. Scheduling Turfgrass Irrigations. Turf Tales Magazine. Spring Issue.

International Society of Arboriculture. 1997. Tree Care Consumer Information. Mature Tree Care (http://www.isa.org).

International Society of Arboriculture. 1997. Tree Care Consumer Information. New Tree Planting (http://www.isa.org)

International Society of Arboriculture. 1997. Tree Care Consumer Information. Plant Health Care (http://www.isa.org)

Larson, T. 1995. Greenwaste Recycling: Closing the Loop. California Landscaping, March Issue.

Shigo, A.L. 1993. 100 Tree Myths. Shigo and Tree Associates, Durham, NH.

Shigo, A.L. 1991. Modern Arboriculture: A Systems Approach to the Care of Trees and Their Associates. Shigo and Tree Associates, Durham, NH.

Western Fertilizer Handbook – Horticulture Edition. 1990. California Fertilizer Association, Interstate Publishers, Danville, Ill.