Take Time to Winterize–

(Continued from Page 17)

tery's state-of-charge every 30 to 45 days during storage. Recharge the battery whenever its capacity drops below 75 percent. An open-circuit reading of 12.4 volts or less means the battery is below 75 percent of full capacity.

Handling and mounting: Because vibration is the No. 1 battery killer, make sure you properly torque the battery's tie-down clamps and secure the batteries to the vehicle. One major fleet found that more than 30 percent of premature battery failures resulted from broken battery cases caused by mishandling. To avoid damaging a battery when installing or removing it, then, don't lift a battery by its terminal posts. Also, always loosen the clamping bolts on terminal cables before installing or removing a battery.

Batteries often are the victim of a bevy of other problems that cause no-starts in winter. For example, defects in the charging system– such as slipping fan belts,a faulty alternator or high resistance in the wiring– also will cause batteries to discharge.

Batteries often are the victim of a bevy of other problems that cause no-starts in winter. For example, defects in the charging system--such as slipping fan belts, a faulty alternator or high resistance in the wiring--also will cause batteries to discharge. In addition, when a vehicle's electrical load exceeds its alternator's capacity, excessive battery cycling can result, which can shorten battery life. Even slow-speed driving with several accessories operating can cause battery cycling.

Conditioning cooling systems The next step in winterizing your equipment is to pressure-check the cooling system. Let's consider each aspect.

Radiator. First, check the radiator cap. Do not apply more than the cap's specified pressure. Also, check the cap for leaks. It may pay to replace the cap, but only with one having the same pressure setting.

With the engine running, look for signs of bubbles in the coolant. Engines can't tolerate any air in the system. Check that the coolant level is 1 inch over the top of the radiator core. Also check for contaminants in the system. Take care when doing so; with the engine off and cool, remove the radiator cap. Then start the engine and visually check the water running through the radiator for any contaminants.

Clean radiator fins with compressed air blown from rear to front, and use the light-from-behind method to verify that air passages are free.

Hoses. If you find contaminants in the radiator, it means hoses are deteriorating from the inside. Because hoses are the veins of the powerplant, it is important you keep them in prime shape. To check a hose, first squeeze it firmly. The rubber should be neither soft and lifeless nor hard and brittle. An overly soft hose indicates it has been exposed to oil, grease or atmospheric contamination. Soft hoses are dangerous because they can rupture or swell under pressure. Replace any soft hoses. If the hose is brittle, rather than soft, it may crack or break easily. An overly hard hose indicates the hose may be overcured by engine heat, which is the most common cause of hose failure. Replace hard hoses and change the hose's routing to a cooler route through the engine.

In addition, hoses should not rub against other engine and under-hood components. Check hose clamps for tightness, too.

Belts. Check fan belts for condition, tension and alignment. The most common problems are incorrectly sized belts, over-tensioned belts and under-tensioned belts. Under-tensioned belts are worse than over-tensioned belts because they can slip. Use a belt-tension gauge to check. As a rule of thumb, look for deflection of 0.016 inch for every 1

seconds when cranking a diesel. Then let it rest for 2 minutes before trying again. * Don't use more than a small amount of ether when attempting to crank a diesel. Too much can cause a catastrophic engine failure. * Don't use ether in combination with glow plugs--similar to spark plugs--to start a diesel. You can cause the engine to explode.

Storing power equipment What steps must you take to properly store power equipment that you won't use during the winter? On vehicles such as golf carts, garden tractors and electric-start mowers, disconnect the battery or batteries to avoid parasitic voltage loss. Don't forget that completely discharged batteries will freeze at 18 degrees F.

Small power equipment--chain saws, blowers, tillers, edgers, clippers, shredders, etc.--also need extra attention. Three musts you should follow are:

* Liberally lubricate to fight corrosion.

* Drain the gasoline tank, then operate the engine until it runs out of fuel. This practice will prevent varnish from forming inside the carburetor. Also, because diesel fuel can spoil if it gets old, micro organisms can form in it. Draining the tank and running the engine also will rid the tank of any leftover diesel fuel and keep these contaminants from building up as well.

* Do not store equipment in the same location as fertilizers or swimming-pool chemicals. These chemicals are extremely corrosive to any metal parts on your equipment.

Some people change the oil on 4-cycle engines before storing them for the winter. Normally, they require a seasonal oil change. Microorganisms don't seem to bother engine oils, so you don't need biocides to protect the oil on these types of equipment.

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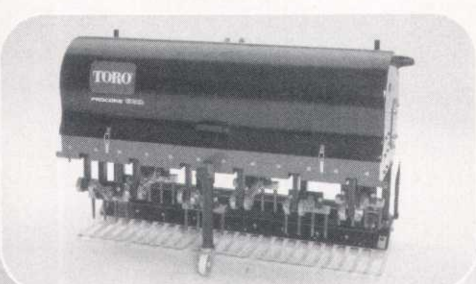

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How Long Can You Irrigate Without Runoff?

By JOE Y.T. HUNG
California State Polytechnic University

When you irrigate, the one thing you want to avoid most is to overirrigate. That is, you don't want to irrigate so much that you waste water--and dollars--when rivers start forming at the edges of a site. To keep from doing so, you need to determine what that maximum runtime is. Infiltration equations are the key.

Using infiltration equations, you can avoid or minimize irrigation runoff. Here, I'll discuss equations I developed that will help you determine what the maximum sprinkler-irrigation runtime should be on your site. We'll also use Kostiakov's and Horton's infiltration equations to help guide you in finding a practical solution to runoff problems.

What are these equations? I used infiltration-test data on bare soil for five types of soil textures (see table, page 42) to produce a series of curves representing the relationship between the maximum sprinkler-irrigation runtime and the sprinkler precipitation rate with different land slopes. You can use these curves to determine the maximum sprinkler runtime for your calculated sprinkler precipitation rate according to your soil type and your land-slope conditions. (Keep in mind, however, when referring to these curves that, because the raw data used to construct the curves was based on bare soil, you should reduce the result from the curves if you're irrigating turfgrass.)

The Hung equation is: $tmax = (1/Pb)\{fo - P + fc[\ln (fo - fc)/(P - fc)]\}$ where: tmax = Maximum irrigation runtime without runoff (hours) P = Average sprinkler precipitation rate (inches/hour) b = Horton's constant (see table, page 42) fo = Infiltration rate (inches/hour) at the start (at time) fc = Basic infiltration rate or saturated infiltration rate = Constant (inches/hour).

We based the infiltration data (obtained from the U.S. Natural Resources Conservation Service--USNRCS) on a 50-percent-available soil-water depletion rate--data that U.S. researchers have used for almost a century in irrigation applications. You can change the percent of available soil-moisture depletion anywhere from 25 to 75 percent. However, as mentioned, the USNRCS based its infiltration test data on the depletion of 50 percent available soil moisture. I constructed all curves based on the above assumption. Therefore, it's best to use the prepared curves if the available soil-moisture depletion is 50 percent or less.

I then applied Kostiakov's equation to obtain infiltration rate vs. test elapsed time. Kostiakov's equation is: $I = K ta$ where: I = Accumulative infiltration rate (inches) K, a =

(Continued on Page 25)

Irrigate Without Runoff–

(Continued from Page 24)

Constants that depend on the soil and initial conditions t = Time after infiltration starts (hours)

In differentiating the first equation with respect to time "t," we have: dI/dt = K a t a - 1

where: dI/dt = Infiltration rate (inches/hour)

Based on this third equation, I obtained infiltration rates at various times from the USNRCS raw infiltration data for the five soil types. I plotted the infiltration rates vs. the elapsed time to obtain the best infiltration capacity curves through the Macintosh Cricket computer-software program for the five soil types.

Figures 2 through 6 (at right) depict the reduced maximum irrigation runtimes for the five soil types on land slopes from 0 to 5 percent, 6 to 8 perce nt, 9 to 12 percent and 13 to 20 percent.

As mentioned in the footnote of the table (page 42), the USNRCS obtained the five "b" values for the five types by solving Horton's equation using the infiltration-capacity curves shown in Figure 1 (above right).

Horton's equation is: f = fc + (fo - fc) e -bt

where: f = Infiltration rate (inches/hour) fo = Infiltration rate at time = 0 fc = Basic infiltration rate (inches/hour) b = Horton's constant t = Elapsed time (hours)

Now that you're familiar with the formulas, let's look at some examples in which you can apply the information you've learned. I developed this information into Figures 2 through 6 (above), as mentioned.

Putting the formulas into real-world equations

Example 1: Imagine your sprinklers cover an area of 20 x 20 feet. They have a total flow rate of 8 gallons per minute (gpm). What, then, is the maximum runtime per application? Let's assume your soil is loamy and the land slope is 6 percent. You first must calculate the average precipitation rate (PR): Precipitation rate (inches/hour) = (96.3 x gpm)/A

where: 96.3 = Conversion factor A = Area (square feet)

Thus, the PR = (96.3 x 8)/(20 x 20) = 1.92 inches/hour. Now look to Figure 3 (previous page) with this information. There, you see that for the PR of 1.92 inches per hour, on loam soil with a slope of 6 to 8 percent, you have a maximum runtime of about 30 minutes.

Example 2: You have a flat turf area, 40 by 40 feet, irrigated by sprinklers with a total flow rate of 30 gpm. The soil is sandy loam. Knowing this, find the maximum runtime for the sprinklers per application.

Using the same formula, your PR = (96.3 x 30)/(40 x 40) = 1.81 inches/hour. >From Figure 2, you find that for the PR of 1.81 inches per hour, on sandy loam soil and a slope of 0 to 5 percent, you have a maximum runtime of 70 minutes.

(Continued on Page 29)


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MGCSA RESEARCH CHAIRMAN RICK FREDERICKSEN, CGCS, second from left, along with his group from Woodhill Country Club including Dave Schwartz, left, Dave Simeon, second from right, and Paul Kubista.

Irrigate Without Runoff–

(Continued from Page 25)

If, after you've figured your required irrigation runtime and it exceeds the maximum runtime, then you'll need to make repeated cycles of application. In this case, the required irrigation runtime depends on following several primary factors: Irrigation frequency Evapotranspiration (ET) rate Precipitation rate Maximum soil-moisture holding capacity Percent of the available soil-moisture depletion Overall irrigation efficiency.

Within the maximum soil-moisture-holding capacity, if the required irrigation runtime exceeds the allowable maximum runtime, then you must cut short the irrigation-application time, and you need repeated cycles.

Example 3: Assume that your soil is the same as in Example 1 (loamy soil). Use the sprinkler PR from Example 1 (1.92 inches/hour) with the following additional data: Land slope = 0 to 5 percent ET rate = 0.24 inches per day Field capacity (FC) = 22 percent (by weight) Permanent wilting point (PWP) = 10 percent (by weight) Apparent specific gravity (As) = 1.40 Available soil-moisture depletion (C) = 50 percent Grass root depth (D) = 6 inches = 0.5 feet Overall irrigation efficiency (E) = 75 percent.

You can use the formula to calculate the required irrigation water and runtime. The required irrigation water in inches per irrigation application is:

R = C (FC-PWP) as D/100 = 0.5 (22-10) 1.4 x 0.5/100 = 0.042 inch

Thus, the required irrigation runtime per application is:

t - R/(PR x E) = 0.042/1.92/0.75 = 0.060 hour = 54 minutes

You can calculate irrigation frequency as:

Lf = R/ET = 0.042/0.24 = 0.18 day

Perhaps you want to adjust the irrigation frequency from 2.1 days to a whole number of days, such as 2. Then, you would change the amount of water you should apply per irrigation application to:

Radj = (2/2.1) x R = 0.952 x 0.042 = 0.04 inch per irrigation

In Example 1, the maximum irrigation runtime allowed for the selected sprinkler is 30 minutes and the actual irrigation runtime is 54 minutes. So the selected sprinkler probably is not adequate.

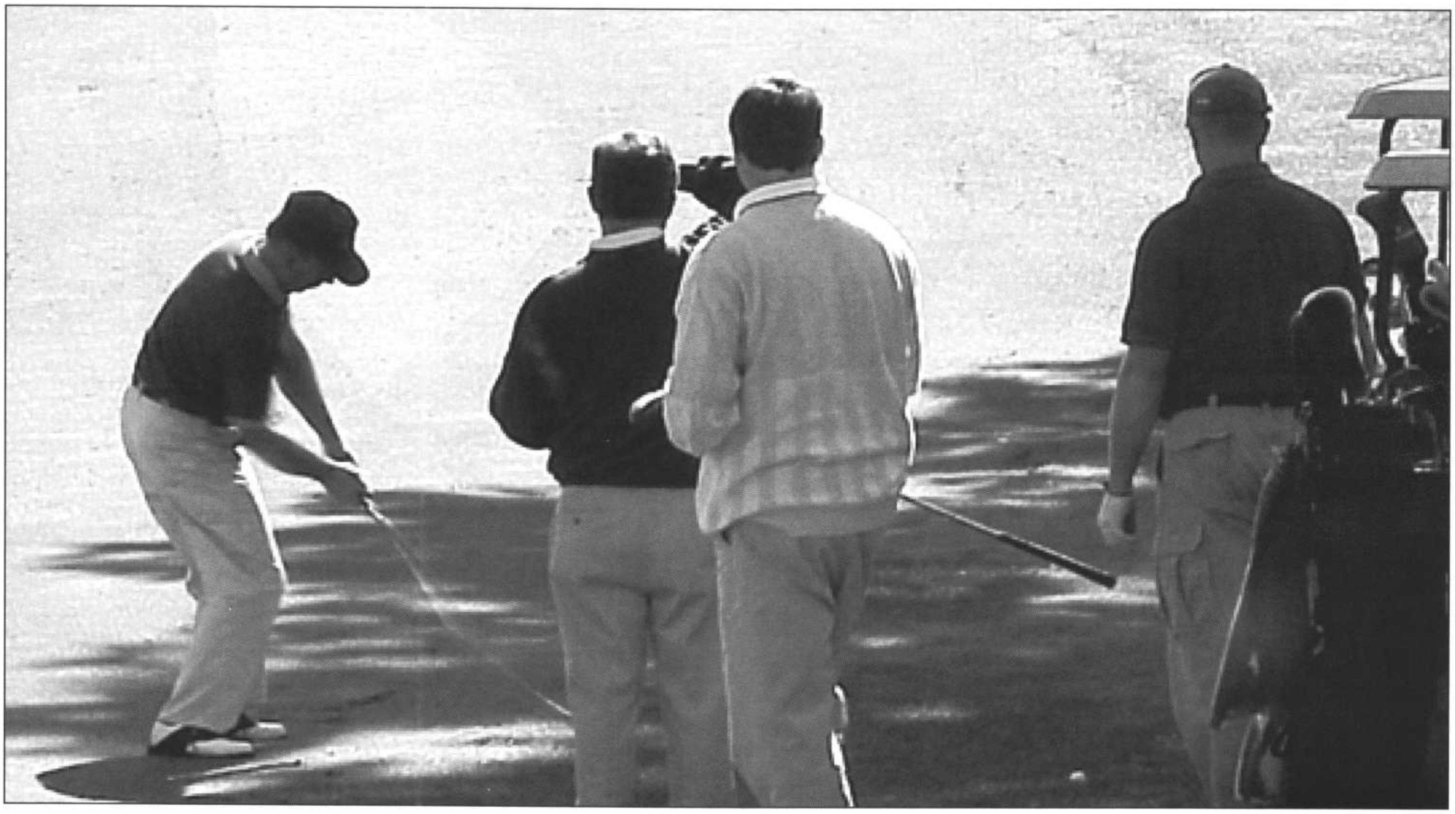
Of course, you may think you could simply change nozzles if you've figured your required irrigation runtime and it exceeds the maximum. However, keep in mind that, on an existing system, if you change the nozzle size, it will affect the flow rate and the distal water pressure at the nozzle. You'll also change the diameter of a sprinkler's throw and distort the distribution uniformity.

The distance of throw depends on two main factors: the nozzle's water pressure (or flow velocity--not flow rate) and the angle (with the horizontal plane) of the water-stream trajectory. For example, if you reduce the nozzle size, the outlet will reduce the flow rate. Thus, you should reduce the water pressure loss along the water's travel path. You'll recover the distal water pressure to a higher level. Consequently, the velocity at the nozzle outlet increases and the distance of throw increases. This means your sprinkler will cover more area--but it'll take you longer to water.

Dr. Joe Y. T. Hung is a professor in the Agricultural Engineering/Irrigation Science Department and director for the Center for Turf, Irrigation and Landscape Technology at California State Polytechnic University--Pomona.

* * * *

(Editor's Note: This article was reprinted with permission from the October 1997 issue of Golf Course Maintenance magazine.)



JOHN QUEENSLAND, superintendent at Cedar River CC hits his second shot on the 10th hole during the 2001 Stodola Research Scramble at Edina Country Club on September 25th. Others in John's group include Brian Bergone, Mike Schneider and Jack Kleahn.

Sample Employment Contract

By GCSAA

EMPLOYMENT CONTRACT BETWEEN

[Insert name]
AND THE
[Facility name]

This Employment Contract, made and entered into this _____ day of ______________________________,20____, by and between the __________________________ ("EMPLOYER"), and ____________________ ("SUPERINTENDENT") as ratified by action of the governing board of EMPLOYER at a regular meeting held on ___________,20____. This contract incorporates and replaces all prior contracts and/or amendments thereto.

EMPLOYER is a ______________ facility established for the purpose of maintaining, operating and conducting, among other activities, a ________ hole golf course and related facilities and grounds ("facilities").

In consideration of the mutual promises of each, and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged by both the EMPLOYER and SUPERINTENDENT agree as follows:

1. TERM
The EMPLOYER employs the SUPERINTENDENT, and the SUPERINTENDENT hereby accepts employment as a SUPERINTENDENT for a _______-YEAR term commencing on ___________,20____ and ending on ___________,20____. EMPLOYER may by specific action and with the consent of SUPERINTENDENT grant a ______-year/month extension of the existing contract. EMPLOYER shall notify SUPERINTENDENT in writing, [____ days] or [prior to ___________,20___] of its intent concerning such extension and/or nonrenewal.

2. CONDITIONS OF EMPLOYMENT
A. Duties
The SUPERINTENDENT is the Director of Facilities and Operations ("DFO") for the Golf Course and related facilities and shall faithfully perform the normal duties of a Golf Course Superintendent for the EMPLOYER as prescribed in the job description, as may be assigned by the EMPLOYER and as more particularly set forth in paragraphs 1 through 15, immediately hereafter.

The duties of SUPERINTENDENT shall include, but are not limited to the following:
1. Control and direct the maintenance, care and improvement of the grounds and golf course facilities, including maintenance facility, irrigation system, mowing and other golf course machinery.
2. Implement policies established by the EMPLOYER through its governing structure such as the Chairman of the Greens and Grounds Committee.
3. Assist the Chairman or other supervisor in preparing the annual budget for approval by the Finance Committee and the governing board.
4. Apply, inventory, and maintain all pesticides in accordance with applicable laws, regulations (federal, state and local), and prudent management practices.
5. Coordinate tournaments and related activities with the golf professional and manager at the facility.
6. Recruit, interview, hire, and supervise employees in accordance with applicable state and federal laws.
7. Work with and attend management meetings of the Grounds Committee, or other appropriate managing entity, in determining policy and scope of activities.
8. Coordinate the hiring of any independent outside contractor retained by the golf facility related to the operations of the golf course and related facilities.
9. Maintain the golf course, including fairways, roughs, greens and grounds in a manner consistent with the budget provided by EMPLOYER.
10. Prepare a budget for golf course operations and capital improvements.
11. Enforce the rules and regulations at the golf facility as they presently exist or as they may hereafter be modified or amended and develop a policy of reporting such violations by golfers, members and guests.
12. Develop, implement, and review on an annual basis, policies and procedures affecting the orderly maintenance of the facilities and equipment.
13. Recommend and supervise the purchase, lease, installation and maintenance of golf course equipment and improvements including, but not limited to, cart paths (excluding cars), tee markers, waste receptacles, flags, signs, toilets, water fountains, shelters and the like.
14. Prepare a long-range plan for improvements to the facilities and projections for financial and membership needs and coordinate the implementation of the plan.
15. Perform such other duties as are customarily performed by SUPERINTENDENT and such other duties as assigned by EMPLOYER.

B. Limitation of Authority
Notwithstanding other terms herein, SUPERINTENDENT shall not have the right to make contracts or commitments for amounts in excess of _______ Dollars ($_______) for or on behalf of EMPLOYER, without first obtaining the express written consent of EMPLOYER.

C. Supervision of Superintendent
SUPERINTENDENT reports to the ___________________ (owner, board of directors, board of governors, president, green chairman, general manager or other supervisor). If that person is temporarily absent or unable to perform [his or her] duties, then the SUPERINTENDENT shall report to the _______________. In no event shall there be more than one person at any time acting on behalf of the EMPLOYER insofar as control of the SUPERINTENDENT is concerned.

D. Criticism, Complaints and Suggestions
The EMPLOYER, individually and collectively, shall refer all criticisms, complaints and suggestions called to the EMPLOYER's

(Continued on Page 32)