Irrigation Management

by Ross Kurcab

Irrigation management balances watering and manipulating water resources to achieve the optimum ratio between turfgrass health and vigor and field usability and playability. It integrates three basic areas of understanding: understanding your irrigation system, understanding the agronomics of your field, and understanding the needs of the field's users.

When to irrigate

In general, deeper and less frequent irrigation encourages the deep rooting and plant health that enables turfgrasses to withstand stresses, including the stress of play. Turf first signals its need for water with persisting footprints and equipment-wheel marks. This is due to a lack of turgidity, which causes the turf to take longer to "snap back." This is the time to begin irrigation.

As the drought stage advances, the turf canopy begins to develop a slight purple hue. If you wait too long to address the problem, the turf turns brown and eventually dies, especially in sand or sandy soils.

Irrigation frequency

Matching irrigation frequency to the agronomics of your field requires a blending of various soil and plant sciences.

Determine the infiltration and percolation rates of your field's soil. The infiltration reading defines the rate at which water enters the soil. The percolation rate determines the rate at which water moves through the soil profile.

These rates and your irrigation system precipitation rate are measured in inches per hour. Rates vary based on the soil's sand, silt and clay content (soil texture); the degree of compaction, thatch and slope; and various other factors.

A good irrigation design integrates the basics of water delivery source, piping, heads, controllers, and other components into a system that is compatible with your field's uses and your available water resources. *Courtesy: Hunter Industries*

Your field's physical characteristics affect the infiltration rate/precipitation rate relationship. Slope reduces infiltration rates. A thick thatch layer (greater than 1/2-inch) also slows the infiltration rate. The greater the degree of compaction, the slower the infiltration and percolation rates. Consider these factors in determining your irrigation program.

Check soil infiltration rates with a soil probe. For greater accuracy, check with a double ring infiltrometer (call your local county extension agent to find one).

Remember, these rates will vary according to the existing moisture levels within the field and other agronomic variables. You may have several "zones" of differing infiltration on the same field, and may have to program irrigation accordingly.

Be sure to take weather variations into account. Factors include: the amount of natural precipitation; humidity levels; and temperature highs, lows and averages. Track sun and shade patterns and their impact on water needs. How will wind affect your irrigation management? When is play scheduled on the field?

Consider your turfgrass cultural practices in relation to irrigation needs. Highly fertilized turfgrasses have a faster growth rate and more succulent growth, so they have a greater need for water. Mowing height affects both evaporation rates and plant water demands. Are your mower blades sharp? This can save a lot of water! Are you conducting the turf cultural practices that tend to result in

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a deep, healthy root system capable of mining water from deep within a drought-stricken soil?

How much water?

Different turfgrass species and cultivars have varying irrigation needs. However, as a general rule, moisten the soil to a depth of at least four to six inches with each irrigation. This is where the vast majority of the roots will be.

An irrigation system's precipitation rate is the measure of the amount of water it delivers over a given area in inches per hour. You must determine the precipitation rate. This can be done mathematically by multiplying the total gallons per minute over a given area (GPM) by a constant (96.25), and then dividing this value by the total area (in square feet):

$$\text{Pr (in./hr.)} = \frac{96.25 \times \text{Total GPM}}{\text{Total Area (sq.ft.)}}$$

Or, you can determine the precipitation rate within individual irrigation zones simply by measuring the amount of water collected in rain gauges or straight-sided cans during a half-hour of operation. Double this measurement to arrive at the output in inches per hour.

The precipitation rate shouldn't exceed the infiltration rate. You may need to build a series of waiting periods (with "soak time") into the irrigation program on heavy soils. You need to allow sufficient water movement within the soil profile without creating "puddling" or runoff.

Install as many quick couplers as you can afford. Strategically place them around your field of play to allow hand watering to supplement irrigation and reduce its frequency. *Courtesy: Jacobsen*

Scheduling irrigation

Timing must balance the needs of the turf with the needs of the field's users. Early morning irrigation (between 4 a.m. and 8 a.m.) generally offers lighter winds and cooler temperatures, so there's less evaporation and drift. Because the turfgrass canopy has longer to dry, there's less disease pressure.

However, morning or early afternoon play may be scheduled. Frost may restrict irrigation at certain times of the year. The optimal irrigation timing may conflict with other field maintenance operations. Again, you have to balance the needs of both the field's users and the turf.

Irrigation system design basics

Before a field is built, identify the water source. Water quality, availability and accessibility are essential components of a workable irrigation system. Develop a wish list for the system in terms of capabilities and capacity, but be aware of your budget.

Work with a system designer who understands that a sports field is not just more acres of turf. Look at what the field is going to be used for, and determine an irrigation system layout that is compatible with the field's needs. The designer must consider not only the basic layout of the field, but also any differing zones of play that affect field conditions. These areas may be best served by separate irrigation zones that can be programmed differently than other zones.

On a football field, for example, irrigation zones should run the length of the field to allow different irrigation management between the hashmarks. On soccer fields, different zones should serve the goal mouth areas. For baseball fields, the outfield and infield turf areas require different zones, and the system must provide for some method of skinned area irrigation.

A good irrigation design integrates piping, heads, controllers, water delivery source, and other components into a system that is compatible with your field's uses and your available water resources.

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At the same time, it must remain within your budgetary constraints. More zones and greater flexibility within the controller provide more management options, but at a cost. You have to balance your needs with your budget.

Cautions for system design

Whenever possible, avoid running a live, pressurized main line underneath the field of play. Instead, place it off to the side. The lateral lines that are only under pressure during irrigation can be placed under the field.

For safety, place the valve boxes, quick couplers and drainage boxes off the field of play. Install sprinkler heads that have very strong retractable springs, a small top size, and a protective covering.

To better accommodate irrigation management for special events, include as many quick couplers as you can afford. Strategically place them around your field of play to allow hand watering to supplement irrigation and reduce its frequency.

Bury your main line as deeply as you can - at least below your average frost level. You'll keep the irrigation system operational later in the fall and start it up earlier in the spring. Here along Colorado's Front Range, more turfgrass stands are lost to desiccation than to cold temperatures.

Install sprinkler heads that have very strong retractable springs, a small top size and a protective covering.
Courtesy: Hunter Industries

Also, avoid exposed (above ground) sprinkler pipes. If you can afford it, consider having a heated building for your main valve and main line tap point.

Include a main "kill switch" in any athletic field irrigation system. This could be a main valve that shuts off the water supply, a switch that interrupts the electrical circuit that powers the valves, or a combination of the two. The last thing you need is for sprinklers to come on during a game.

Finally, make sure you protect your controller from lightning damage with proper grounding.

One irrigation system - multiple uses

Syringing the field helps reduce turf heat stress. A single rotation of the sprinkler head delivers a light dusting of water that cools the grass as it evaporates. With Denver's high temperatures and low humidity levels, this can drop canopy temperature by 15 degrees F, and the cooling effect can last three to four hours.

Use the irrigation system to wash in fertilizers or pesticides, and to bring field moisture capacity to optimum levels for specific maintenance procedures. Injection systems even add fertilizers, micronutrient packages and soil amendments to the irrigation water.

You can also use the system to "pop" grass seed, and to keep sod moist enough to establish a strong root system. If conditions are right, use it to thaw canopy frost.

Controlling your system

To properly manage your irrigation, you need to understand how the system works and what it is - and isn't - capable of doing. At the very least, you must know the system's precipitation rate and your soil's infiltration rate. The more you know about the system's components and hydraulics, the greater your ability to manage it.

Whether you've assisted with the design or have inherited an established system, acquire or develop an "as built" blueprint of the installation. This shows the system as it is installed, including any variations made from the original design to accommodate particular field situations. On an inherited system, you may have to track the design yourself every time you do a repair.

Note the location and type of piping, show connection points, and plot the

placement and type of heads. Then determine the flow rate (in gallons per minute) for each zone on the field and for each landscape area tied into the irrigation system. Compare that to the capacity (water flow and pressure) of your water source to determine which type, and how many zones can be operated at the same time.

Every irrigation system will have a certain range of peak efficiency - a measure of the operating pressures and flow in which the system is designed to function. The pressure at the source is generally based on availability and how quickly you need to get water onto the field. It takes the right pipe size, thickness and length to accommodate that pressure (measured in pounds per square inch). The flow of water (measured in gallons per minute) varies according to several factors, including available pressure, pipe size and length, and the number of outlets. Make sure your irrigation system is operating within the range specified by the design.

Too little pressure restricts the system's water delivery rate and may result in dry spots. Excessive pressure may create water droplets that are so small that fogging or drifting occurs. The irrigation system should deliver water as uniformly as possible across the field (matched precipitation).

On a football field, irrigation zones should run the length of the field to allow different irrigation management between the hashmarks.

You'll need the flexibility to adjust the precipitation rate and water delivery pattern for matched precipitation under varying circumstances. This may mean changing the heads within a zone, changing the nozzles, or changing the inlet size to increase or decrease the flow to a head. You may also need to adjust the distance of the stream of water (throw) delivered by a head.

Changing these variables will change the coverage area and precipitation rate. A change in one part of the zone will affect the entire zone.

Generally, your system will deliver a stream of water that reaches from one sprinkler head to another (head-to-head throw). If the throw is too short you'll have dry spots; if it's too great you'll have wet spots.

At system start-up in the spring,

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inspect each sprinkler head to ensure proper turning, arc, distance of throw, and full retraction. Develop a repair list. Staff members should monitor the system during daily maintenance and report any variations. Recheck the system monthly and after aeration, heavy roller use, or any maintenance procedure that might damage the heads and/or pipes.

Note the rotation time of each of the heads under normal operating conditions. For syringing, you can then program the time for one rotation of the heads within a zone. Also, slower than normal rotation of a head or series of heads can alert you to a problem.

Water bubbles or puddling quickly signals a broken pipe. A drop in pressure when the system is operating will be harder to detect, but is often the first sign of a problem. If possible, include flow meters, circuit diagnostic self-testing, and other diagnostic aids to detect problems in the irrigation system design.

Striking the right balance

The timing and frequency of irrigation represent a compromise between the needs of the turfgrass and the needs of the field's users. There will be some give-and-take on both sides, but the users win more often than not. As Dr. Jackie Butler used to say, "There are no grass problems, only people problems."

For scheduled play, keep the field in the upper half of field capacity (for moisture levels), a bit on the dry side, but not bone dry and not saturated. A slightly drier field is less subject to compaction and it provides more solid footing. A saturated field is slick, too soft, and much more susceptible to wear damage.

Anyway you approach the matter, turfgrass needs the benefits of proper irrigation. So pick the most critical event day, or days within an extended event, and manipulate the irrigation program to deliver the optimal moisture levels for play during those most critical periods. Good luck! ❑

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