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Watering Lawns

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Water applied to supplement rainfall is essential to maintain attractive lawns in most parts of Hawaii. Much development in Hawaii occurs in areas that are considered true deserts—they receive less than 10 inches of rainfall per year. Even in areas receiving abundant natural rainfall, its seasonal distribution is sometimes uneven and not adequate to maintain uniformly green grass with good vigor throughout the year. Supplemental irrigation in the proper amount is necessary to prevent lawns from turning brown or dying from moisture stress.

Watering is one of the most often abused and least understood aspects of turfgrass culture. Improper watering is wasteful, costly, and damaging to the grass and landscape. As Hawaii continues to grow and develop, water use for turf and landscape plantings will become more and more restricted. Our water use must be more efficient and follow the principles of good water management. In the following, we describe three basic steps to an efficient watering program.

1. Determine when water is needed

The worst possible irrigation program is to water turf daily for 5–10 minutes. Unfortunately, this is the most common method used by homeowners and many professionals. Light, daily irrigations encourage shallow rooting, thereby reducing the amount of soil the turf has available for water storage. The grass depends on the daily drink and wilts or browns very quickly if it does not receive it. Brief daily irrigation encourages disease problems, weed invasion, accumulation of thatch, and soil compaction. Shallow rooted turf is also more prone to traffic injury.

A newly seeded or planted lawn is the exception to the rule of deep watering. For the first few weeks after planting, water frequently and lightly to encourage seed germination or good growth of stolons or sprigs. As the lawn becomes established, water less frequently and for longer periods.

There is no single irrigation schedule that will meet the need of every landscape. Timing of waterings depends on the site, soil type, management practices (mowing and fertilizer application), season of year, and type of turf. An efficient and economical way to irrigate a lawn is to apply water at the first signs of water stress. Research has shown that turf watered at the first signs of visual wilt used 33 percent less water. Waiting too long, however, can cause browning or permanent damage. The initial signs of stress may include the following:

- Color changes, and bluish-gray areas can be seen in the lawn.
- Footprints or tire tracks remain in the grass for several hours after they are made.
- Many leaf blades are rolled or folded in half.
- A soil sample from the root zone feels dry.

Soil moisture sensors can be used to determine water stress. A *tensiometer* measures the soil moisture tension (how strongly the soil holds water against plant uptake) and can be used to determine when to irrigate. By monitoring the turf and the tensiometer, the soil moisture tension level at which wilting and drought stress symptoms appear can be determined. This will be relatively constant, regardless of season. By irrigating just before the symptoms would have become evident, water is applied only when it is needed. Research has shown that tensiometer-scheduled irrigation used half as much water as a rigid schedule.

An easy method to calibrate an automatic irrigation system is simply to turn off the irrigation system and note the number of days required for stress signs to show in the turf. Adjust the timer to irrigate one day before stress symptoms appear. For example, if wilting and stress are evident after four days without water, set the system to water every three days. The time for stress symptoms to appear will vary with exposure to wind and sun. Evaluate and set the timer for different irrigation zones individually, and allow for seasonal variations.

The best time of day to water a lawn is early morning, when the wind is less likely to alter distribution patterns, evaporation is minimal, disease development is minimized, and water pressure is usually greater. Watering during the heat of the day wastes water because evaporation rates are very high. Watering in the evening results in water staying on the grass all night, encouraging the spread of fungal diseases. Avoid watering in the evening.

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2. Determine how much water should be applied

The amount of water absorbed at any one time varies with the amount of water present in the soil, the water-holding capacity of the soil, and the soil's drainage characteristics. An efficient irrigation wets only the root zone, does not saturate the soil, and does not allow water to run off.

Water enters a dry soil more rapidly than a wet soil. This is particularly true of heavy clay soils, where 1 inch of water may take less than an hour to soak in when the soil is very dry, but as much as 5 hours when it is wet. Once the surface soil is saturated, water movement into the soil (percolation) depends on soil texture. Soils vary in texture from sandy to loamy to clayey. Soil texture determines both the rate at which water moves into the soil and how the water is held in the soil. Water moves rapidly into sandy soils, but their ability to store plant-available water is limited compared to loams and clays. Therefore, sandy soils need to be irrigated more frequently. Clayey soils, in general, absorb water slowly and hold relatively large amounts of water, although much of that water is held so tightly that plants cannot absorb it. Some of Hawaii's clay soils, particularly in the rainier areas, are an exception to the general rule: they are well aggregated, and water moves through them rapidly. The soil type and location will therefore greatly influence when and how much water should be applied during an irrigation.

Information on soil characteristics can be obtained from soil survey reports of the islands, but much of what you need to know about your soil can be determined by a simple experiment. Push a can with both ends removed into the soil and observe the time it takes for water poured into the can to enter the soil. Observe this both when the soil is dry and when it is wet. Percolation through a moist sandy soil can be as rapid as 2 inches per hour, 10 times faster than through a heavy clay soil. One inch of water applied to a moist sandy soil may be absorbed in a half hour, compared to 2–3 hours for a moist loam or clay-loam and 5 hours for a moist heavy clay that is not of the free-draining type.

Plant roots generally grow in the upper 12–24 inches of soil. This area, called the root zone, is the plant's only source of available water. Sandy soils hold about 1 inch of plant-available water in the top 12 inches of soil. Loams will hold about 2–2½ inches of plant-available water in the upper 12 inches. The percolation rate of a soil is the rate at which water drains through it. Overwatering can saturate the root zone, leading to deep percolation, where water drains below the root zone and is lost. Deep percolation can leach fertilizers and other chemicals from the root zone into the groundwater. Most of the water losses in landscape irrigation occur through deep percolation, which cannot be seen and is not easily measured. Many landscape managers mistakenly attempt to overcome poor uniformity of water infiltration by applying more water than is necessary, so that an adequate amount is received at the driest location. This practice is the leading cause of deep percolation.

Generally, Hawaii turfgrasses require no more than $\frac{3}{10}$ inch of water per day in mid-summer and about ⅕ inch or less in the cool winter months. Plant water use is also higher in hot, dry areas than in cool, high-elevation areas. Under extreme conditions, water use can be as high as ⅖ inch of water per day. One inch of water is equivalent to 620 gallons of water for each 1000 square feet of lawn. The average lawn will therefore require 5000–7000 gallons of water per 1000 square feet per month. Grasses use much less water during seasons when they are not actively growing.

A simple irrigation schedule would be to apply ¾–1 inch of water at the first visual signs of wilt. Typically, this will require two or three waterings per week during summer and fall. Watering too much reduces root growth and increases disease problems for turf and landscape plants.

To determine the application rate of the irrigation system, measure the amount of water applied by placing several straight-sided cans in the sprinkler pattern. Run the system for 15 minutes and measure the depth of the water in each can. Calculate the amount of water the system applied in one hour by multiplying the measurement by 4. The uniformity of the coverage can also be determined in this manner.

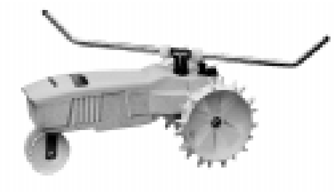
Many sprinklers and irrigation systems apply water faster than the soil can absorb it. Water is wasted through surface runoff when the amount of water applied exceeds the amount entering the soil. Runoff from home and commercial landscapes also carries away nitrogen and pesticides, making it a potential contributor to non-point water pollution.

Infiltration (absorption of water into the soil) and runoff potential can be determined by running the irrigation system or sprinkler and observing how long it takes for runoff to occur. Irrigating longer than that time will be wasteful. Runoff can be controlled by changing the size of the sprinkler heads or the application method to reduce the rate of application, or by reducing the length of time that the system operates. It may be necessary to irrigate a lawn or a zone for several short periods during the day to allow sufficient time for the desired amount of water to infiltrate into the soil without runoff. Core-aerating the turf with a machine that removes small plugs of soil greatly improves the water infiltration rate into compacted or clay soils and turf with thatch.

Irrigation with brackish water requires some specialized watering techniques. Consult an expert if you are using brackish, non-potable, or reclaimed water to irrigate your lawn.

Types of hose-end sprinklers

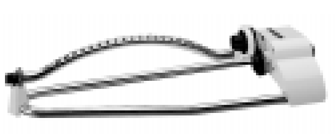
The **impact** or **impulse** head shoots water out in a pulsating action. Some have an adjustable screw or paddle that breaks up the water jet stream and disperses the water pattern. The head can be set to water a full or partial circle. This type of sprinkler is best for large areas and accurately distributes water when placed in an overlapping triangular pattern.



The **traveling** sprinkler usually has a whirling-type head and the traveling action can cover a large area without assistance. The path is guided by hose placement, which can easily be manipulated for large, irregular lawn shapes. Level ground and an overlapping pattern are required for even water distribution. This type is not suited for newly seeded lawns or other situations where soft soil conditions can lead to a stuck sprinkler.

The **whirling head** is good for watering tight locations. It deposits large amounts of water in a short period of time and must be moved often. Use a 50 percent overlapping pattern, because most of the water is deposited close to the sprayer head.

The **stationary** or **fixed-spray** head is usually a circular or square pattern. Water is applied in irregular patterns even with overlapping moves, making it difficult to water large areas uniformly. It is best for spot watering in tight locations. It deposits large amounts of water in a short period of time and must be moved frequently.



Oscillating sprinklers deliver water in a rectangular pattern and deposit much of the water in the middle of the pattern near the sprinkler head. It is difficult to achieve even distribution on large areas with this type. The pattern can be adjusted to cover smaller rectangular areas and other tight locations.

The **perforated-hose** sprinkler is a flat, pin-holed hose that sprays fine streams of water and may require several moves to uniformly cover a medium-sized area. Water delivery is slow, which is good for hard-to-wet locations. The hose can be manipulated to water irregular areas and long, tight areas along a house or walkway. It can be placed under and around dense shrubs to reach hard-to-water areas.

Illustrations courtesy of L.R. Nelson Corporation

3. Determine how water is to be applied

The most common way of watering lawns is by overhead irrigation. The least expensive way to apply overhead irrigation is a sprinkler on the end of a hose. Impact, oscillating, and some fixed-type sprayers can be adjusted to various spray patterns. Rotary, fixed, and perforated-hose sprayers have only one pattern, which can be adjusted in size by varying the water pressure. Overhead sprinklers can be connected in tandem or series to expand the area of coverage from a single water outlet. Some degree of automation can be obtained by attaching a battery-operated timer at the water outlet (at left, below).

If overhead hose-end sprinklers are the primary source of water in hot, dry areas, the irrigation system often requires considerable time and attention to maintain a quality lawn. Also, with the exception of the perforated-hose types, hose-end sprinklers often apply water much faster than most soils in Hawaii can absorb it, and there is potential for run-off and waste of water.

In-ground, automatic systems are expensive to install, but if they are properly installed and programmed they can maintain a higher quality lawn with less work and less waste of water than overhead, hose-end systems. In-ground systems require regular maintenance and close attention to their settings. Most problems, including wasted water, that occur with automated systems are due to the operators rather than the systems. For example, an attempt to produce a showcase lawn can lead to over-irrigation. Incorrect timer settings lead to water being applied at the wrong time of day. Failure to modify settings to compensate for changing water needs and precipitation can under-apply or waste water. Operators usually set each zone to run for the same length of time, although adjusting the run-time for individual zones will often solve some watering problems. Automatic systems that are carelessly set and monitored are conspicuous to observers, leading them to a bad impression of the level of management skill and social responsibility not just of the system's operator but, by extension, of the household, business, or agency occupying the grounds. To ensure proper functioning of an automatic, in-ground sprinkler system, inspect the following aspects of the system frequently.

- Check sprinkler heads for even spray pattern, over-throw onto paved areas, and direction of spray.
- Check for damaged sprinkler heads and replace leaking ones. Check them after mowing and other operations that can result in damage.
- Check the time and settings on the clock-controller and adjust them for seasonal differences.
- Do not mix sprinkler head types within the same zone.
- Make sure the system irrigates uniformly.

Tips on water conservation

Much of the water used around the house is for outside uses. An efficient watering program for turfgrass combines proper mowing height and moderate levels of fertilization to produce a superior lawn. Turf that is allowed to grow too tall before mowing will have an increased water requirement. For effective water conservation, adjust mowers to the higher end of the optimum mowing height range for your turf, and keep the blades sharp. Mow frequently so that not more than one-third of the leaf blade is removed in a mowing. To increase water and air movement into the soil, core-aerify compacted soils and de-thatch heavily thatched turf. This is best done in the cooler seasons; in mid-summer, coring may cause excessive drying of the soil.

Maintain proper fertilization. Adequate levels of potassium apparently reduce the tendency of turfgrasses to wilt. By using slow-release fertilizers, nitrogen will not wash away as quickly as it may with soluble fertilizers. Apply only enough nitrogen to support the desired level of growth.

Operate automatic irrigation systems for maximum efficiency. Use a "rain-out" to shut the system off automatically if it is raining. These devices are inexpensive and can be adapted to almost any automatic irrigation system. Set the duration of irrigation for different sprinkler zones to reflect real water needs and soil conditions, rather than setting all zones for the same amount of time. Avoid watering during the hottest part of the day or late in the evening. Move portable sprinklers frequently enough to avoid puddles and run-off.

Turf's resistance to drought

Many people believe that a drought-tolerant grass requires less water. Drought tolerance is a plant's ability to *survive* extended periods of moisture stress. If a grass with this ability is to be maintained in an attractive condition, it will need about as much water as a grass that is not considered drought tolerant. Water use rates of the various grasses common to Hawaii lawns do not differ greatly. Drought tolerance does become important, however, during periods of water use restrictions. On Oahu, Maui, and sometimes elsewhere in Hawaii, water use restrictions are becoming more of a reality.

Relative drought tolerance of common Hawaii turfgrasses

HIGHEST

bermudagrasses
zoysiagrasses
St. Augustinegrass
seashore paspalum
centipedegrass
carpetgrass
hilograss

LOWEST

The last word

Application of irrigation water requires more judgement on the part of the homeowner or turf manager than any other aspect of lawn management. Common mistakes made by the average homeowner include watering too often for short periods of time and applying water faster than the soil can absorb. Soils and local environments vary widely over short distances in Hawaii, and environmental conditions affecting turfgrasses change throughout the year. Therefore, watering schedules should be carefully planned and, when necessary, adjusted. Whenever possible, irrigate problem areas by hand and postpone the need to water the entire lawn. Problem areas, or "hot spots," may be caused by compacted soil that absorbs water slowly, slopes from which water runs off, southern or western exposure, and warming from being next to driveways or walkways (especially the narrow strips of lawn between sidewalks and streets). Perforated-hose sprinklers that supply water slowly and have a narrow water distribution pattern may be useful in these areas.

See also CTAHR publication L-10, *Using tensiometers for measuring soil water and scheduling irrigation.*