Virginia Cooperative Extension
Virginia Tech • Virginia State University

Publication 426-322

Irrigating the Home Garden

R. Allen Straw, Extension Specialist, Horticulture, Southwest Virginia Agricultural Research and Extension Center

Adequate soil moisture is essential for good crop growth. A healthy plant is 75 percent to 90 percent water. The plant needs that much water to carry out vital functions, including photosynthesis, support (rigidity), transpiration, and transportation of nutrients and sugars to various parts of the plant. During the first two weeks of growth, plants are becoming established and must have the proper amount of water to build their root systems. Too little water can stunt or even kill tender seedlings, while excessive moisture can prevent roots from moving out into the soil searching for water and nutrients. Without a sufficient root system, hot, dry weather can adversely affect vegetable plants as they mature. In areas prone to repeated drought, select drought-resistant varieties when buying seed or plants.

During the growing season, from April to September, vegetable crops need enough water each week to wet the soil to a depth of 5 to 6 inches. In most soils, this is about 1 inch applied at one time in the form of rainwater, irrigation water, or both. However, some vegetables, like tomatoes and muskmelon, may require close to 2 inches of water per week for optimum production. Keep a rain gauge near the garden or check with the local weather bureau for rainfall amounts, and then supplement the rainfall with irrigation water, if needed. There are ways, however, to reduce the amount of water you have to add.

When overhead watering bare-ground crops, one thorough watering each week of 1 to 2 inches of moisture (65 to 130 gallons per 100 square feet) at one time is usually enough for most soils. Wet the soil to a depth of 5 to 6 inches each time you water and do not water again until the top few inches of soil begin to dry.

Trickle or drip irrigation systems use water much more efficiently. When you use a drip system, especially in combination with mulch, you will use a more frequent or continuous application of water in smaller amounts to maximize vegetable production. Even when you use a drip or trickle system, a good thorough wetting of the soil once a week for the first couple of weeks is the best technique to develop healthy root systems.

During those times when cultural practices simply aren't enough, when rainfall is sparse, and the sun is hot, watering can benefit the garden with higher yields and may save the garden altogether in severe drought years.

Irrigation as a Water Deposit

When irrigating vegetable plants, it is easy to think that you are "watering" the crop. What you are really doing is adding water to the soil. Think of this process as "making a deposit" into the water reserves. When the plant uses water, it is making a withdrawal. Just like a checking account, you can only withdraw what is in the account. When it is empty, the plant wilts and dies. Unlike a checking or savings account, however, the soil will only hold so much water. The top 12 inches of soil will generally only hold 2 to 4 inches of available water, depending on the soil type. Applying more than 2 inches, even to dry soil, may result in wasting water.

Reducing Water Demands

All of the water you apply may not be available to plants. This is particularly true with heavy clay soils. Clay particles hold soil moisture tightly. If, for example, there are 4.5 inches of water per foot in this type of soil, there may be as little as 1.5 inches available for plants. A relatively high level of humus in the soil, brought about by the addition and breakdown of organic matter, can improve this proportion to some extent. By causing clay particles to form aggregates or

www.ext.vt.edu

Produced by Communications and Marketing, College of Agriculture and Life Sciences, Virginia Polytechnic Institute and State University, 2015

VT/0515/HORT-178

large clumps of groups of particles, humus also adds air spaces to tight clays, allowing moisture to infiltrate the soil, instead of puddling and running off the top of the soil.

The moisture-holding capacity of sandy soils is also improved by the addition of organic matter. Although most soil water in sandy soil is available, sandy soils typically have low water-holding capacities. The water drains through sandy soils so quickly that plant roots are unable to find much water even a few days after a rain. Humus in sandy soil gives the water something to cling to until the plants need it. Adding organic matter is the first step in improving moisture conditions in the garden.

Mulching

Mulching is a cultural practice that can significantly decrease the amount of water you need to add to the soil. A 2- to 3-inch (6 to 8 inches of loose straw or leaves will compact to 2 to 3 inches of mulch) organic mulch can reduce water needs by as much as half. Mulches smother weeds, which take up and transpire moisture, and reduce the evaporation of moisture directly from the soil. Organic mulches themselves hold some water and increase the humidity level around the plant. If the mulch becomes dry, it may be necessary to add an extra 1 or 2 inches of water to soak through the mulch when doing overhead watering. Black plastic mulch also conserves moisture, but may increase soil temperatures dramatically during the summer (to the detriment of some plants and the benefit of others) if not covered by other mulch materials or foliage. (See Mulches for the Home Garden, Virginia Cooperative Extension publication 426-326, http://pubs.ext.vt.edu/426-326/.)

Shade and Windbreaks

Shade and windbreaks are other moisture conserving tools. Plants that wilt in very sunny areas can benefit from partial shade during the afternoon in summer. Small plants, in particular, should be protected. Air moving across a plant carries away the moisture on the leaf surfaces, causing the plant to need more water. In very windy areas, the roots often cannot keep up with leaf demands, and plants wilt. Temporary or permanent windbreaks can help tremendously.

Critical Irrigation Periods

By knowing the critical watering periods for selected vegetables, you can reduce the amount of supplemental water you add. This can be important where water supplies are limited. In general, water is needed most for germination of seeds, immediately after transplanting, during the first few weeks of development, and during the development of edible storage organs. Following are critical periods for selected vegetables.

Cauliflower	Head development
Corn, sweet	Silking, tasseling, ear development
Cucumber	Flowering, fruit development
Eggplant	Flowering, fruiting
Lettuce	Head development; moisture should be constant
Melons	Flowering, fruit development
Peas	Pod filling
Tomato	Flowering, fruiting

Irrigation Benefits

Irrigation practices, when properly used, can benefit the garden in many ways:

- Aid in seed emergence.
- Reduce soil crusting.
- Improve germination and plant stand.
- Reduce wilting of transplants.
- Increase fruit size of tomato, cucumber, and melon.
- Prevent premature ripening of peas, beans, and sweet corn.
- Maintain uniform growth.
- Improve the quality and yield of most crops.

Irrigation Methods

As a home gardener, you have several options for applying water to plants. Most gardeners either use overhead watering (a sprinkling can, a garden hose with a fan nozzle or spray attachment, or portable lawn sprinklers). You can also use drip or trickle irrigation, which includes soaker hoses (an extrusion product of ground up tires), thin wall drip irrigation tapes, drip emitters, and spray stakes. When properly cared for, quality equipment will last for a number of years.

Some basic techniques and principles for overhead irrigation:

Adjust the flow or rate of water application to about 3/4 to 1 inch per hour. A flow much faster than this will cause runoff unless the soil has exceptionally good drainage. To determine the rate for a sprinkler, place small tin cans at various places within the sprinkler's reach, and check the level of water in the cans at 15-minute intervals.

When using the oscillating type of lawn sprinklers, place the sprinkler on a platform higher than the crop to prevent water from being diverted by plant leaves and try to keep the watering pattern even by frequently moving the sprinkler, overlapping about half of each pattern.

Do not wet the foliage in the evening; this can encourage diseases. Early-morning watering is preferred.

It is best to add enough water to soak the soil to a depth of 5 to 6 inches. This requires approximately 2/3 gallon of water for each square foot or 65 to 130 gallons for 100 square feet of garden area. This varies with soil type. Frequent, light irrigations will encourage shallow rooting which will cause plants to suffer more quickly during drought periods, especially if you do not use mulches. On the other hand, too much water, especially in poorly drained soils, can be as damaging to plant growth as too little water.

Drip or Trickle Irrigation

Several types of drip or trickle equipment are available. The soaker hose is probably the least expensive and easiest to use. It is a fibrous hose that allows water to seep out all along its length at a slow rate. However, this is not an engineered product and tends to lack uniformity of application. Soaker hoses also make great chew toys for critters like ground squirrels.

There are also hoses with holes in them that do basically the same thing; water drips out the holes (drip irrigation tape). With the latter type, a flow regulator usually has to be included with the system so water can reach the end of the hose without bursting the tape from too much pressure. Most drip tapes are designed to operate at 8 to 12 psi. Pressure-compensating drip tape has been developed that maintains an even flow across the length of the tape even on uneven slopes.

Place perforated plastic hoses or soaker hoses along one side of the crop row or underneath the mulch. Allow the water to soak or seep slowly into the soil.

Finally, there is the emitter-type system in which short tubes, or emitters, come off a main water supply hose. Emitters put water right at the roots of the desired plants. This is generally the most expensive form of irrigation and the most complex to set up, but it has the advantage that the weeds in the area are not watered and evaporation from the soil is minimized. This type of system is best used in combination with a coarse mulch or black plastic and for small, raised-bed or container gardens.

Drip systems generally have some problems with clogging from soil particles and/or mineral deposits. All water, including municipal water sources, should be filtered. Due to possible sand and silt particles, well water is subject to plugging emitters more than municipal water and must be filtered. To prevent plugging, always install drip tapes or emitters with the holes pointing up.

It is wise to make a complete investigation and comparison before purchasing a drip irrigation system.

Gray Water

If water supplies are short in your area and you consider using gray water (water from household uses) on your vegetable garden, you should know that at the time of writing this publication, it is illegal to use untreated gray water for irrigation in Virginia. For more information on water "reuse," please refer to Water Reuse: Using Reclaimed Water for Irrigation, Virginia Cooperative Extension publication 452-014 (http://pubs.ext.vt.edu/452-014/). For more

information on gray water usage and regulations, please contact the Virginia Department of Health.

In those states where the use of gray water is allowed, the following rules are recommended:

- Do not use "black water" (any water run through the toilet) because of the possibility of contamination from fecal organisms.
- It is best not to use kitchen wastewater that contains grease, harsh cleaners, ammonia, bleach, softeners, or nonbiodegradable detergents.
- If using water from the bathtub or washing machine, use only mild, biodegradable soaps. Omit softeners and bleaches. Allow wash and rinse water to mix, if possible, to dilute the soap content. Never use a borax-containing product (such as washing soda) in water to be used on a garden because of the danger of applying toxic levels of boron.
- Apply gray water to the soil, not to plant leaves.

Summary

In summary, good irrigation practices are critical to good plant growth and fruit production. In addition, good irrigation practices are efficient and conserve water while providing for the plant's needs.

This publication was originally authored by Diane Relf, Extension Environmental Horticulturist.