Irrigation for Home Gardens: Part One

Why and How: An Abbreviated View

By Art Scott

IRRIGATION is the artificial application of water to land to assist in the production of crops, ornamentals, or food.

Why

Water is essential to maintain plant rigidity (turgor). If a water deficit occurs, you will see a wilted plant.

Nutrients are in a soil solution that are actively moved across a cell wall to be transported to the areas of the plant where they are needed. ATP is the energy-carrying molecule that enables this process. More later.

Evaporation of water primarily through the plant leaves create a negative pressure which pulls the water and nutrients up through the plant's vasculature (the xylem).

Some Causes of Wilting

The most frequent cause you will experience is a lack of water. If your irrigation method does not deliver enough water, your plants will appear droopy (lack of turgor). The solution is to increase the amount or the frequency of irrigation. If you have containers, they may require watering more than once a day during the hot summer.

A second cause is too much water. If the soil spaces are filled with water, the absence of oxygen will cause a problem with the active movement of nutrients across cell membranes. Water moves into the root by osmosis and the concentration gradient is equalized or reversed. This does not affect all plants, especially aquatic plants. Often this is mistaken for insufficient water and more is applied, worsening the problem. Check the soil and if it is moist, more water is not needed.

A third cause of wilting is root rot, which can have several initiating causes including a soil-borne fungus activated by an excess of water. Treating the fungus is knowing which one is the cause. Will Afton is our county agent and he will help any St. Tammany Parish resident send in a sample to the plant diagnostic lab in Baton Rouge. He will even pay for the postage.

The most serious and long-acting cause is bacterial wilt. The vasculature (xylem) is clogged by the bacterial growth, reducing the flow of water and nutrients up from the roots. This is a major problem, because the bacteria will remain in your soil for years and will infect subsequent plantings. Check the Diseases and Pests article under the Gardening heading on this website for photos of bacterial wilt and more info.

When to Irrigate Your Plants

Dig down with your finger. If the top 2 to 4 inches are dry, it is time to water. The length of time between irrigation sessions will be determined by how long it takes for this top area to become dry again.

Factors affecting how often

Mulch will reduce the evaporation of soil moisture and will help conserve water, which results in longer intervals between irrigation sessions.

Individual plant needs. Some plants can withstand drought, others require more frequent watering, while others like to have moist roots.

Windy weather will increase evaporation through the plant (transpiration) and from the soil. You probably will not notice much of an increase on a gentle breezy day.

Hot days will also increase evaporation. Check the soil more often.

Plants in containers will need more frequent watering. You may have to send water to these plants twice a day during the hot summer days.

Recent rain will reduce the need for irrigation depending on the amount. A good reason to buy a rain gauge. Place it in an area so the rain will have unobstructed access. If it is a distance from your home, get one with large, easy-to-read numbers.

Many irrigation timers will have a rain delay setting so if several days of moderate rain are expected, just a push of a button or two will set the delay feature for up to 3 days.

Morning irrigation is preferable for several reasons. You will provide moisture going into the hottest part of the day when water demand by the plants is the highest. Moist leaves can be susceptible to disease, and the sun will dry the foliage rapidly, reducing the likelihood of this problem. If you irrigate in the evening, your plants will be more attractive to pests, encouraging them to spend the night, and the moist foliage is more likely to develop fungal infections.

How Long to Irrigate

Wait about 15 minutes after irrigating for 45 minutes. Using a garden trowel, check that the water has penetrated to a depth of 6 to 8 inches. If not, continue, noting the additional time and recheck with your trowel. Once you have determined the length of time needed to get the moisture down to this depth, you will only need to periodically recheck as the seasons change.

Why 6 to 8 Inches for Moisture Depth

Your plant roots will only grow where there is moisture. If the moist soil is only in the top few inches, that is where the roots will be. Shallow roots are more susceptible to drought. And at this level, the shallow roots will not offer much structural support for the plant to support flowers or fruit. Wind resistance will be minimal.

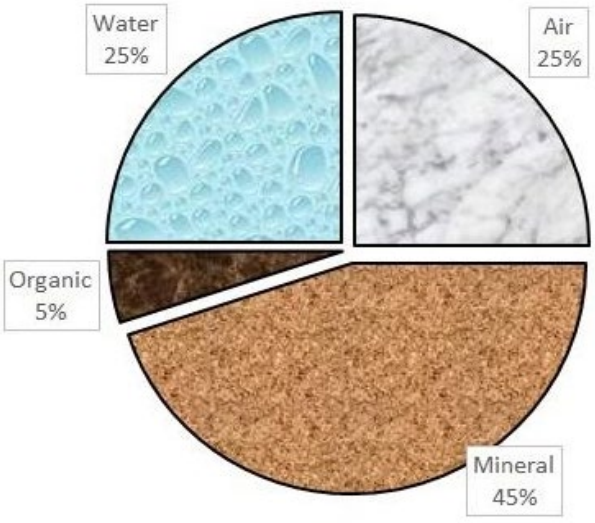
With the moisture extending down deeper, the roots will be kept moist for a longer time, especially if you irrigate when the top few inches are dry, while the deeper roots are still in moist soil. The roots will have a continual water supply and you will need less water to irrigate to depth and the plants will be healthier.

Soil Composition

The characteristics of your soil will affect the amount of water required to irrigate to depth as well as the speed of absorption and the retention capacity.

A soil with too much sand will not retain water because it is too porous. The water flows past your plant roots.

If there a high percentage of clay, the small particle size will prevent rapid drainage with the water hanging around too long, causing root problems. High clay content soils tend toward compaction – minimal spaces for air and water.



Pie chart with percentage composition of an ideal garden soil from North Carolina State University. The mineral content consists of silt, sand, and clay in varying percentages. The combination of the three is called loam when the percentage of clay is low.

An ideal garden soil is loam with almost equal amounts of sand and silt but a lower clay content. This combination of sand (provides good aeration and drainage) and silt provides good moisture retention but less nutrient retention than clay.

Decomposing organic material must be replenished each year. It provides good drainage and attracts beneficial organisms that keeps the soil alive.

The air and water fill in the spaces between the soil components. These spaces also provide room for the roots to easily expand to anchor the plants and gain access to the nutrient-rich soil solution.

RABBIT HOLE (a metaphor for an entry into the unknown) — In most cases a minimal amount of information is all that we need to have a basic understanding.

We experienced this earlier when we discussed nutrient and water transport across cell membranes in plant roots.

You will again be exposed to an abbreviated explanation with pH and alkaline hydrolysis, two additional, basic concepts to be aware of.

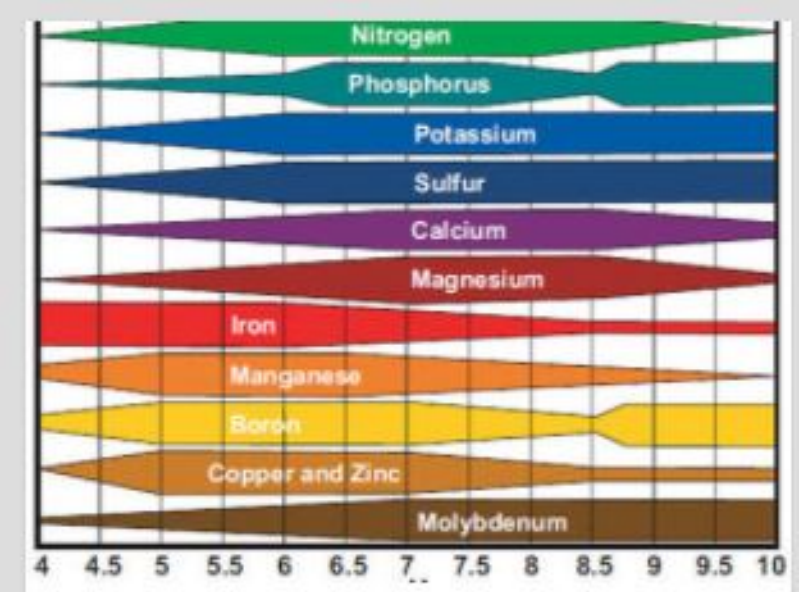
If your interest is piqued and you want to know a lot more (going deep down into the rabbit hole), there is the internet.

pH is a measure of the acidity or alkalinity of a soil. The pH is the percent of free hydrogen (H^+) ions — the more H^+ ions present, the more acidic the solution.

The opposite is the hydroxyl (OH^-) ions which result in an alkaline environment.

A neutral reading is 7. While lower numbers are more acidic, the higher numbers represent a more alkaline environment.

Most plants perform best with a pH range of 6.0 to 7.0. This is also a good range for soil organisms which have a hard time surviving at a pH below 6. A soil test from the AgCenter will provide your garden pH plus a lot more information.



This chart represents the nutrient availability at varying pH levels. It is from Clemson University. A range between 6 and 7, where most plants do well, is also a range where the nutrient uptake is good for all the nutrients listed. Probably a reason why the plants prefer this pH range.

Alkaline hydrolysis is a process that degrades some pesticides to a non-toxic form. Especially susceptible are organophosphates and carbamates insecticides, more so than fungicides and herbicides.

This loss of effectiveness is measured in terms of its half-life. If the half-life is one hour, the amount of the active ingredient is reduced to 50% in one hour; to 25% in two hours, and to 12.5% in three hours.

Most are stable when mixed with water with a pH of 5, which is much below most municipal water supplies, that are normally at a pH of 8 or above.

Some are moderated by buffering solutions contained in the pesticide formulation.

The pH of water delivered to my home is 8.2. I also have a well that supplies two outside faucets at a pH of 5.78. The well water is what I use to mix all my chemicals sprayed on plants.

Range for safe drinking water is 6.5 to 8.5 per the EPA. A pH above 9 is okay to drink but the water will have an off, slightly bitter taste.

HALF-LIFE IN WATER FOR SOME PESTICIDES			
Chemical	**pH 7**	**pH 8**	**pH 9**
Carbaryl – Sevin (trademark, Bayer) – pesticide –	24 – 30 days	2-3 days	1-3 days
Malathion – pesticide –	3 days	19 hours	<12 hours
Trichlorfon – pesticide – selective insecticide for caterpillars and grubs plus others for use on lawns and golf courses and to control mole crickets, sod webworms, ants, crickets plus others	6 hours	1 hour	no listing

Your water supplier should be able to tell you the pH. Usually it is more alkaline because acidic water can corrode pipes and cause metal leaching. Pens for checking pH are available online, ranging from $15 to $40 and much more. Test strips are available for about $10, but some may be off by 2 points or more.

One solution you might consider, because not all chemicals are susceptible, is to use the diluted mixture immediately.

- Do not store any extra left in the sprayer for use in a few days.
- Do not take a break after mixing and before spraying. Do not dawdle.

HOW

Stand and Deliver

THIS METHOD IS A VERY LIMITED APPLICATION FOR MOST GARDENS and does not need a lot of description. The only requirement is a garden hose.

Standing and watering your plants with a hand-held garden hose has limited effectiveness for most of our gardens. You must stand and deliver the water for an exceptionally long time to get the ideal penetration into the soil.

It is an ideal system if you have only a few plants or pots because you will not get tired and stop before proper depth of moisture is reached.

Soaker Hose

Spiral layout for a densely planted ornamental bed

Often referred to as a leaking pipe method, the faucet is turned on until droplets of water form along the length of the hose.

The ideal length is 25 feet to keep an even pressure along the length of the hose.

You can go up to 50 feet, but there will be a reduction in pressure with water that reaches the distant end.

Increasing the pressure is not a viable solution because of the tendency of most of these types of hoses to spring leaks.

Rupture from high water pressure.

The hose can be placed in a linear fashion or coiled if you have a densely planted ornamental flower bed, or if you have a lot of plants concentrated in a small bed.

A soaker hose is more tolerant of small amounts of dirt and algae than a drip irrigation system

Sprinkler–Intermittent or Oscillating

There are two shortcomings for both types. The foliage is moistened which predisposes plants to fungal infections.

Water hitting the ground beneath the plants will cause pathogen containing splatter from the soil to reach the lower foliage.

It is difficult to limit just to the garden without including the surrounding lawn, walkways, and trees.

You must set up the hose for each use. The hose lies across the lawn, which can cause the grass to die if left for a long period of time in the hot sun. Plus, you may cut the hose with a lawnmower.

Intermittent sprinkler irrigating this flower bed and surrounding lawn.

Drip Irrigation—Also called Micro Irrigation

This is the most efficient method, as 90% – 95% of the water is used for plant growth. There is less waste because the irrigation method delivers the water to where the plants are. The resistance to drought and plant diseases is increased.

You can adjust the amount of water flowing to each plant depending on the degree of water required by that plant for optimum growth. You control the water flow by using different emitters, which come in different shapes with differing flow patterns. The emitters also have different flow rates and pressure tolerances,

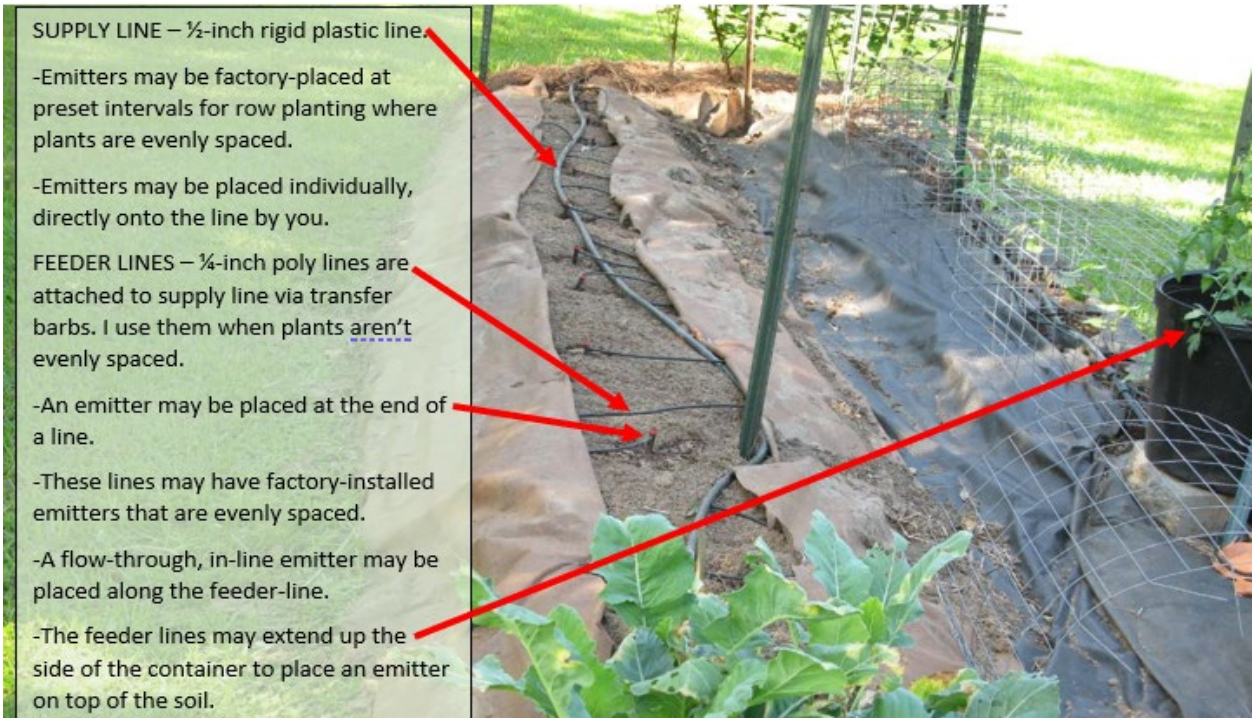
Drip irrigation is not just for beds. Smaller feeder lines can extend up to post baskets. This one is planted with thyme on top and oregano on the sides. The emitters are inside the line, spaced every 6 inches and placed by the manufacturer. The drip line in this basket circles around the top.

You can also use these lines to irrigate hanging baskets.

End of Part One

Get a Glimpse of What is to Come

Coming Soon Part Two, Drip Irrigation in Detail



Basic layout of drip irrigation vegetable bed.

Drip irrigation on both beds. Foreground bed has oregano, lemon balm, basil and yellow squash. Bed in the background is planted with tomatoes and eggplant.

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