Irrigation of the Home Garden: Vegetables and Bedding Plants in South Florida

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Introduction

Attention to the choice and placement of landscape plants can significantly reduce the amount of water used in the garden. By choosing plants with some degree of drought tolerance, and grouping those with any exceptional need for water together, it is possible to conserve scarce water resources. Strategies are also available to save water through more effectively managing the irrigation of home lawns. For information on these topics the University of Florida - IFAS publications listed at the end of this document should be consulted.

The present fact sheet is concerned more with supplying water to the vegetable garden and bedding plants, and as such is a companion publication to "Raised Beds for South Florida Gardens". Choosing an efficient means of irrigation in conjunction with an appropriate means of mulching are the principal means of reducing the amount of water that needs to be supplied to a vegetable garden.

Most of the homeowner problems encountered in growing vegetables and many annual bedding plants in Miami-Dade are related to inattention to irrigation practices. A brief summary of water related problems is to be found at the end of this document.

A reliable means of watering a vegetable garden is essential in Miami-Dade since most of the familiar temperate climate vegetables are grown during the dry winter months. For most gardeners this will mean using city water, though in some instances well-water is used, especially if a full irrigation system is installed.

If you are planning to dig a well as part of an irrigation system, you will need the necessary permits from your local city government or the South Florida Water Management District. You may wish to have the water tested before use as to salinity, pH and particulate content.

If you are using city water on your garden, do not use any that passes through an installed water softener that replaces the calcium in the water with sodium (most ion exchange systems), since this could increase the salinity of the soil (reverse osmosis and magnetic systems are safe).

The choice of systems available to irrigate the garden can range from a simple hand held watering can to an installed automated irrigation system. Whichever system is chosen it is important that it maximizes the amount of water going to the plants root system, and minimizes losses due to evaporation. For this reason lawn sprinklers are a poor choice as a universal means of watering a garden, particularly for vegetables and many bedding plants. Of the water that is applied much is lost to evaporation or run off, and the unavoidable wetting of the foliage encourages disease. Lawn sprinklers are designed to broadcast water over a relatively large area, and as such are ideal for turf.

As a rule of thumb winter grown vegetables should be receiving 1-2" of water per week (the upper limit more appropriate for raised beds) from rainfall plus that supplied by irrigation. It is useful to install rain gauges[1] to assess how much supplemental water need be

[1] A simple rain gauge can be made using an indelible pen to mark ½ " increments on any straight-sided clear container, such as a jam jar. Make sure the diameter of the container opening is the same as the base.

supplied. Another indicator is the condition of the soil, where the top 1" of soil should be allowed to dry out in between applications of water.

Water should be applied in one or at most two deep applications per week. To provide 1" of water for every 100 sq ft of plant bed will require approximately 65 gallons of water. The best time of day to water is in the morning just about sunrise, though this is not so important if a drip irrigation system is being used. Avoid watering late in the day to avoid the risk of plant edema (see below) in susceptible crops.

Watering By Hand

If you are using a hose, attach a water breaker nozzle and wand extension to permit gentle watering around the base of the plants, taking care not to damage them when moving the hose. Avoid wetting the foliage when you apply water to reduce the risk of leaf spotting diseases. For a large garden temporary stand-pipes can be installed, linked to the main water outlet, thereby reducing the length of hose that needs to be maneuvered around the plant beds. In order to comply with Miami-Dade code requirements the water outlet must be fitted with an ant-siphon device to prevent back flow of water into the main supply.

For a small vegetable garden a watering can with a long neck (to reach under the lower leaves) fitted with a fine rose spray (to gently soak the soil) is recommended.

Simple Gravity Feed Irrigation Systems

The most elementary systems involve the use of a water reservoir to gravity feed water to a simple metering device so that water slowly seeps into the soil. One such system uses soda bottles as the water reservoir, the flow of water being regulated by a special plastic cone that fits onto the bottle. The bottle is inverted and the cone inserted in to the soil at the base of the plant.

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A more elaborate system uses a water filled plastic bag, mounted on a stake, as a reservoir to feed water by means of a length of tubing to a series of drippers placed at the base of a small row of plants. These and similar devices are useful for a small garden, particularly with raised beds where there is sufficient depth of soil to support the cones or stakes. Since no more than 4 – 8 gallons of water would be needed per application for a small garden, water can be transported to the garden in containers. This avoids the need for piped water on site, a useful feature for a children's small class garden.

Installed Irrigation Systems Using Piped Water

For larger gardens, where piped water should be available, there are more appropriate systems. The use of porous rubber soaker hoses is ideal for the vegetable garden. They are buried or laid across the surface of the soil in the plant bed where they "sweat" moisture along their entire length. Apart from conserving water, by slowly delivering it to the root zone of each plant, this type of hose has

one other positive environmental feature in that they contain at least 60-65% recycled rubber from automobile tires. In order to function precisely, water pressure should be maintained at no more than 10 psi and a 200mesh filter installed to remove particulate matter that could clog the hose. No more than 100' lengths of hose should be used and provision made to occasionally back flush each installation.

In addition to an anti-siphon device (see above), the hose, pressure regulator and filter, it is recommended that timer(s) are part of the system to permit automatic watering. This is especially useful for a garden (e.g. community or school) where there is not always somebody on site, and in general it permits watering during the early hours of the day when it may not be convenient to manually attend to an irrigation system. Timer settings should be reviewed according to water needs (factoring in rainfall and soil conditions) on a weekly basis. For systems using an irrigation pump, an automatic rain shutoff should be installed to prevent unnecessary watering.

For a 4' wide vegetable bed, the soaker hose should be snaked down the middle of the bed with loops 3' wide spaced 1' apart. To estimate how long to water, follow the calculations in the footnote[2], making adjustments for different water flow rates. For a given brand of hose the flow rate can differ and is dependent on the length of hose and water pressure.

Alternatively, there are metering devices that will shut off the water after a pre-set volume of water has been supplied. Estimate the volume by calculating the area to be irrigated, multiply this by the depth to obtain the volume in cubic inches. Divide this figure by 241 to convert to gallons.

[2] A 100' length of hose looped 3' (width) by 1' down the length of a 4' wide bed will extend for 25' and cover 100 sq ft. To provide 1" of water, 1440 cu in (120 x 120 x 1) or approximately 65 gallons (1440/231) need to be supplied. At 10psi and a flow rate of 1 gallon/min/100' hose length, this would mean irrigating for approximately 65 minutes.

If more than one length of soaker hose is required, attach a multiple outlet to the main water supply, plus a pressure regulator and timer for each line to enable maximum flexibility. For any system add together the flow rates for each separate irrigation line and ensure that it does not exceed 75% of the flow rate at the main water outlet.

Where the total flow rate is in excess of that at the main outlet, water the garden in sections that are below the 75% limit. Automatic timers will simplify matters if water has to be supplied sequentially to different sections of the garden. With larger gardens, or those having plants with diverse water needs, the area should be divided into zones that enable plants having similar water requirements to be served by the same irrigation line.

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Similar in concept to the porous soaker hose are others manufactured with small holes along their length through which water can drip. As with all systems it is essential to be able to control water pressure so that water is evenly delivered along the length of the hose.

More Complex Irrigation Systems

The most expensive and efficient irrigation systems use drip emitters to deliver a slow trickle of water directly to the root zone of a plant or group of small plants. Apart from conserving water, by directing it to the root zone, less water is made available to neighboring weeds. Used in conjunction with black plastic mulch, problems with weeds can be greatly reduced. The system uses a main irrigation line to pipe water via two sub lines to manifolds that feed numerous

lateral lines equipped with regularly spaced emitters. There are a variety of different types of emitters, from simple regularly spaced holes in the lateral lines, to attachments that automatically compensate for changes in water pressure.

Emitters can be chosen according to the situation, with some more suited to watering vegetables and bedding plants and others for landscape shrubs or individual trees. Different types of emitters should not be placed on the same irrigation line.


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It is also possible to introduce plant nutrients into the water used to irrigate plants (fertigation) through the use of fertilizer meter injectors. Nitrogen (as urea plus ammonium nitrate) is most commonly supplied in this manner, as well as chelated forms of micro-nutrients (Zn, Fe) where needed. Some nutrients, in particular phosphorus, can cause problems since they are liable to come out of solution, a problem aggravated by the high pH of the water in Miami-Dade. There can also be problems with nutrients becoming concentrated in the very top layers of soil, above most of the root zone, where they are unavailable to the plant.

It should be possible for a competent "handyman" to install an irrigation system having no more than 200' of laterals and operating at 25-30psi (main supply). For a more extensive system the input of a qualified irrigation specialist is highly recommended.

Although investing in an irrigation system will ensure more economical use of water and save time, the benefits will only be realized if the system is routinely monitored (e.g. leaks and blocked emitters) and repaired as needed. Micro-irrigation systems of the type described above are susceptible to clogging from minerals present in water or, less likely for city water, growth of algae or slime producing bacteria. The lines should be regularly back-flushed and not left unused; frequent use helps to prevent plugged openings.

Signs of Plant Problems Due to Incorrect Soil Moisture

Too much or too little soil moisture as well as inappropriate methods of applying water can all cause visible signs of plant damage and disease. Too little soil moisture causes wilting, often not observed until afternoon as temperatures rise and plants loose more water. Insufficient soil moisture can also limit fruit set in vegetables such as tomatoes and cucurbits. Drying winds can also exacerbate the problem, with plants exhibiting scorched leaf margins. A lack of soil moisture can also cause nutritional problems since with less water uptake there is a reduced uptake of available soil nutrients. If there is a severe lack of soil moisture, apply water slowly since a sudden increase can result in damage such as head splitting in broccoli.

Too much soil moisture causes plant roots to die through lack of oxygen as a result of poor soil aeration. Foliage becomes much paler in color, and wilting occurs as the soil becomes waterlogged. Soil that is too moist encourages disease to develop in the roots and the stem at the soil line, and this too will cause plants to suddenly wilt and die.

If vegetables or annuals are grown from seeds sown directly into the plant bed, soil that is too moist increases the risk of a soil borne disease that causes emerging seedling stems to collapse at the soil line (damping off).

When a plant takes up more water than it can loose through normal transpiration, a condition called edema can develop in which cells in the leaf tissue "burst" due to the excess water. Areas of the leaf where this happens later appear dried and corky and often feel rough. This is a relatively rare occurrence and where vegetables are concerned, is associated with a period of cool cloudy weather following a soaking rain as can occur when cold fronts stall over South Florida during winter. The condition has been observed in broccoli and eggplant locally. Allow the soil to dry out and do not water on cloudy days.

Summary

The following points should be considered when reviewing your options for watering bedding plants or a vegetable garden:

1) How large is the area to be irrigated – for a small garden careful hand watering requires the least financial outlay.
2) If time is a factor in a small garden, a gravity feed system could be a better option.
3) In a larger garden (e.g. a single 4'x25' raised bed), a soaker hose provides the least financial outlay for an automated system.
4) In a garden with diverse irrigation needs costs will increase for an automated system.
5) Can I install the system I have chosen myself, or should I call on the expertise of an irrigation specialist?

Further Information

Trenholm, L.E., Gilman, E.F., Knox G.W. & Black, R.J. 2002. *Fertilization and irrigation needs of Florida lawns and landscapes.* University of Florida IFAS Publication ENH 860.

Knox, G.W. 2002. *Coping with drought in the landscape.* University of Florida IFAS Publication ENH 70.

Haman, D.Z., Clark, G.A. & Smajstria, A.G. 1989. *Irrigation of lawns and gardens.* University of Florida IFAS Circular 825.