A WORD OR TWO ABOUT GARDENING

Conserving water in a Miami-Dade vegetable garden.

After June's near record rainfall, evaluating how best to conserve water is probably not near the top of your gardening 'must do' list. You are doubtless more concerned about potential storm damage, and belatedly realizing that you should have already attended to pruning those black olives at the front of the house! So why devote this article to the topic of water use in the garden? The unfortunate fact is that like a hurricane, restrictions on water use are more a case of when rather than if. We shouldn't need the threat of enforced restrictions before evaluating how to use water economically and conserve soil moisture. This should have been fully integrated into the way we plant and manage our landscape. Last month's article in this column dealt with raised beds, including the many advantages for those planning a home vegetable garden. At this time as you decide how best to construct your raised bed(s), consider which of the irrigation methods discussed below could also be incorporated into your plans.

For those new to gardening in Miami-Dade, a little perspective as to local climate conditions will probably be helpful. Late fall through early spring, which corresponds to our vegetable growing season, is dry season. Annual rainfall for Homestead is about 60", but 40-50" of this total falls between mid May to October. In contrast from mid December to mid May the average rainfall is about 8", and for the past 6 years this has ranged from 4" (1999-2000) to almost 11½" (2002-2003), when a moderate El-Niño event influenced our weather. As these figures demonstrate a reliable means of watering is fundamental to a successful winter vegetable garden.

As a rule of thumb the Miami-Dade vegetable garden should receive 1-2" of water (including rainfall) per week in two applications – the upper level more likely for a raised bed. Distribute several rain gages to measure rainfall (use an indelible marker to mark off ½" increments on straight sided glass jars). For 100 sq ft of garden 65 gallons will provide 1" of water. The best time to water is early morning, though this is not so important if a drip or capillary irrigation system is being used (see below). If you aren't sure when and how much it has rained or when you last watered, inspect the top 1" of soil. If this has dried out it is time to water.

While there is clearly a need for a reliable means of watering the winter vegetable garden, it is more than just simply turning on an outdoor faucet. Oh, and before turning on the faucet remember it is a Miami-Dade code requirement that any outdoor water outlet must be fitted with an anti-siphon device. Now that our faucet is up to code, how do we deliver water to the vegetable garden? Obviously the simplest method is to hand water, but even here we can save water. Rather than a pistol type nozzle use a wand type extension fitted with a water breaker. Water can then be gently directed to the soil around the base of the plant where it is needed. This also avoids wetting foliage and splashing soil onto the stem/lower leaves thereby lessening the risk of disease. For a very small garden you don't even need a hose; use a long neck watering can fitted with a fine rose spray.

If you don't have time to water by hand, a variety of simple irrigation systems are available. The most basic rely on gravity feed from a container of water, which is attached to a plastic probe that allows water to slowly seep into the surrounding soil. These are worth considering if you have a small raised bed, don't have room to store a hose pipe or for a small vegetable garden (e.g. school) that lacks piped water. One simple system uses old soda bottles with the bottoms cut out as water reservoirs. A special plastic cone screws onto each bottle to regulate water flow. The bottle is inverted and the cone inserted into the soil at the base of the plant. Another slightly more expensive device utilizes an upturned plastic bottle supported by a screw-on plastic spike (that is stuck in the ground) with attached tubing. The tubing feeds water to an adjustable metering device that is pushed into the soil between each plant. Several settings are available depending on the type of soil and the water needs of the crop.

Gravity is but one of two principal forces that influence the movement of water in soil – the other is capillary action. Once the pull of gravity on bulk water is lost, capillary action exerts an influence on the movement of water that remains in between soil particles (referred to as capillary water). Capillary water is the most significant source of water for plant roots. Capillary action is the result of both adhesive and cohesive molecular forces. Adhesive forces act to tightly bind a film of water to individual soil particles – this water is unavailable to plant roots. Cohesive forces attract water molecules to one another, including those held by adhesive forces to soil particles. As the soil surface dries, these forces act to cause water to be drawn up into the now open pores between soil particles. Soil particle size determines pore size: water will move more rapidly through larger pores, but further through a narrow size pore. Once soil becomes saturated, through rainfall or irrigation, gravity becomes the dominant force, moving water downward.

A simple example of irrigation by capillary action is a potted plant placed in a saucer of water. Much more sophisticated are underground irrigation systems that rely on capillary action to draw water to plant roots. One such method of irrigation, only recently available in N. America, has been in use in Europe for more than twenty years, where it has found applications from watering planters and raised beds to shrubs and even trees. The method uses special plastic reservoirs which are positioned below the root ball prior to planting and covering with soil/backfill. A fill tube incorporating a water level indicator extends from the reservoir to above the soil surface. Like the gravity feed devices just described, this approach should prove especially useful where piped water is unavailable (needs to be transported) or a hose inconvenient. Although more expensive, water need not be replenished as frequently as is the case with gravity feed. Water reservoirs come in a range of capacities from 1qt to 2½ gallons and more, and should require refilling no more than once a week. For a raised bed, allow about 4" between the reservoir and the root ball of whatever is to be planted. Placement depends on the type of soil, especially particle size and its influence on the capillary action of the soil – the coarser the soil the closer the reservoir should to be placed to the root ball.

Irrigation systems requiring piped water are available from relatively inexpensive kits for a small garden to elaborate custom designed installations requiring the services of an irrigation specialist. Lawn sprinklers are designed to distribute water over a wide area and are inappropriate for the vegetable garden. Used for this purpose they are wasteful of water and wet the foliage, increasing the risk of disease. In addition use of such sprinklers is severely limited when Phase II water restrictions are in force during water shortages. Two alternatives, soaker hoses and drip emitters are ideal for vegetable gardens and bedding plants and are not subject to water use restrictions. Porous rubber soaker hoses 'sweat' water along their length and are a popular and relatively inexpensive system. The soaker hose is connected to a regular garden hose and either lies on top of or is buried just below the soil surface. If laid on the soil surface the hose should be covered by mulch – organic or plastic. Bend heavy gage wire into U shaped fasteners to hold the soaker hose in place. Connect a 200 mesh filter, to remove particulates, followed by a regulator to maintain water pressure at no more than 10 lbs psi. If a supply hose is used attach the filter and regulator between this and the soaker hose. Soaker hoses can be purchased as a kit which will include all required fittings, though the pressure regulator and the filter are not usually included.

With water containing high levels of dissolved calcium, soaker hoses are more likely to become clogged. This is a potential problem in Miami-Dade, especially if well water is used. Consider installing a special filter that uses sodium hexametaphosphate to inhibit calcium deposits, but be wary of magnetic devices that claim to reduce calcium deposits. Most of the evidence of their efficacy is anecdotal, the limited research available rendering their household use questionable. Don't use water from conventional water softeners (exchange sodium for calcium). This can cause a build up of salt in the soil resulting in plant injury. Frequent back flushing will help to remove mineral deposits. Once the vegetable season is over or the bedding plants finished short lengths of soaker hose can be removed and immersed in soapy water containing a descaling chemical (where rubber gloves). The hose should then be flushed with clean water.

No more than 100' lengths of hose should be used for a single run. This can be snaked down a 4' wide vegetable bed with 3' wide loops, leaving 1' between each loop. Laid in this fashion a 100' length of hose could water a 25 x 4' bed. At a pressure of 10 psi and flow rate of 1 gallon/min/100' length of hose it would take about 65 minutes to provide 1" of water. The flow rate can differ depending on which brand of soaker hose you purchase – consult the manufacturer's specifications. Soaker hoses are ideal for intensive systems (square foot, French), being far easier to install compared to drip emitters. By adding a timer to the system it can be set to automatically deliver the requisite amount of water. Alternatively, there are metering devices that will turn off after a pre-set volume of water has been applied. You can estimate the volume in cubic inches by multiplying the area to be irrigated by the depth of water to be applied, dividing this by 231 to convert to gallons. Alternatively use a soil moisture meter to estimate how much water is required to penetrate the top 10" of soil.

More expensive but less liable to clog (see below) drip emitters deliver a slow trickle of water to the root zone of a single plant or group of small plants. The least expensive have emitters built into the tubing, their spacing dependent on the intended use. For small raised beds, there are low pressure systems that operate using gravity feed from a bucket of water placed 2-3' above the soil surface. More widely used for growing vegetables are flat drip tapes. These require a regulator to provide a water pressure of 25 lbs psi, a 200 mesh filter and must be laid perfectly straight without kinks. More costly are systems that use lengths of polypropylene tubing with drip emitters inserted using a punch tool. This allows greater flexibility over the type of emitter chosen and their spacing. For a vegetable garden choose those delivering 0.5 to 1 gallon per hour, spaced every 12 -16". Spacing depends upon soil type – the coarser the soil particles, the less distance between emitters. Capillary action will be more pronounced where soil particles are smaller and result in greater lateral spread of applied water. As a guide place the dripper line about 4-5" from a row of tomatoes, and for a double row (peppers, squash or lettuce) in the center of the row. Various types of drip emitters are available but use only one type of emitter per irrigation line. Where clogging is liable to be a problem choose button drippers or those that can be disassembled and cleaned.

The total flow rate of the installed system should not exceed 75% of the flow rate of the main water supply. If in excess, divide the garden into sections that fall within the 75% limit and water each individually. Where sequential irrigation is necessary timers can be programmed to deliver the correct amount of water to each section of the garden. It is possible to introduce plant nutrients into the irrigation water using special injectors. This is most often used to deliver nitrogen, but other nutrients can be included, though some (e.g., phosphate) can come out of solution where water has a high pH. Routinely back flush and check the lines for breaks and leaking/blocked emitters. No matter how much you invest in an irrigation system, long term benefits will only be realized if it is properly maintained.

As well as considering an efficient means of delivering water, do not overlook the need to conserve soil moisture, thereby reducing the frequency of irrigation. Mulch not only conserves water, it reduces weed problems and moderates fluctuations in soil temperature. In addition mulch can lessen the risk of problems from parasitic soil nematodes as well as disease from soil borne pathogens splashed onto plant surfaces. While there are advantages to using plastic mulch (excellent weed control, lasts entire growing season, warms winter soil and increased yields with red mulch), there are disadvantages. First is cost – the 1.5 mil black plastic that is used for winter vegetables is not cheap – followed by the problem of disposal at the end of the growing season. In addition plastic mulch is impervious to water. For rainfall or above ground irrigation (hand watering) to be effective moisture needs to move laterally (capillary action) from soil at the edge of the mulch that receives water. A partial solution is to punch small holes in the plastic. This is not very reliable and wasteful of water. Plastic mulch should always used in conjunction with an installed irrigation system. At least one kit is available consisting of plastic mulch with a soaker hose already woven is available.

Before laying plastic mulch, a slow release fertilizer should be incorporated into the soil. Lay the mulch flush with the soil surface which should be smooth and level with a slight slope toward both edges to prevent pooling of water around the planting hole. The edges of the mulch should be secured beneath soil. If the plastic does not already have planting holes, these can be cut using a bulb planter. Inverted T slits can be made in the plastic adjacent to the crop row to permit later side dressing with fertilizer. For reasons of space organic mulches will have to be left for a future article, but they are a viable alternative for a home garden. However remember, if using a wood based product as opposed to shredded bark incorporate some extra fertilizer nitrogen into the mulch before use. Finally I cannot close without thanking Dr Kati White, irrigation specialist at UF Tropical Research and Education Center for the benefit of her expertise.

John McLaughlin August 16, 2005