UNIVERSITY OF MARYLAND EXTENSION

Greenhouse TPM/IPM Report

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A Perfect Storm – Thrips, Tomatoes and Ornamentals

By: Karen Rane

We received young tomato plants and potted gerberas in the UMD Plant Diagnostic Lab from a commercial grower last week. The foliage on both plants showed dark brown spotting (see photos). The symptoms are suggestive of infection by Tomato Spotted Wilt Virus (TSWV), and indeed both samples tested positive for this virus. Tomato spotted wilt virus is spread through thrips feeding activities, and has a wide host range. The information provided with the samples provided clues as to how this problem developed. First, the grower held over some potted ornamentals from last year's crop, allowing any pests or diseases on those plants to remain in the greenhouse as well. Second, there was a thrips outbreak a few weeks before the samples were submitted. Third, vegetable seedlings and ornamental plants were being grown in the same greenhouse, facilitating movement of thrips and virus between crops. If all of last year's crop plants had been discarded at the end of the season, the new plants scouted frequently so that thrips were detected and managed before an outbreak occurred, and if tomato transplants (which were destined for commercial high tunnel production) and bedding plants for landscape use were maintained in separate greenhouses, the impact of TSWV in this facility would have been minimized.

Tomato Spotted Wilt Virus symptoms on tomato leaves.
Photo: K. Rane, UMD

Tomato spotted wilt virus symptoms on Gerbera leaves.
Photo: K. Rane, UMD.

Irrigation Efficiency

By: Andrew Ristvey

Despite whether you irrigate by hand, drip, sprayer, rotating sprayer or by boom, there are a number of different procedures to tighten up an irrigation system's efficiency. Irrigation efficiency is a concept that denotes the use of water without waste. Irrigation application uniformity is essential for irrigation efficiency. Uniformity entails the even application of water over surfaces like containers or soil. However, even uniform distribution may be inefficient if water is over applied. Depending on the application system, whether it is by hand, drip or spray, several strategies to audit irrigation systems will be discussed.

Irrigation managers are faced with several important tasks of distributing enough water to plants to support growth, yet do so in an efficient way, making sure there is enough water to go around. Limitations in system design and efficiency can hamper those efforts, decreasing the availability of water and its potential distribution to plants. These inefficiencies can waste time, decrease profits and create environmental problems. What aspects of an irrigation system can examined to increase water use efficiency, potentially increasing the amount of available water and decreasing the risk for waste.

Management of operating pressures is critical for uniform and efficient water application. Designing an efficient system entails having the correct pumps, properly sized irrigation lines and emitters that work with specific operating pressures. Additionally, properly sized irrigation lines are an important part of maintaining operating pressures from pump to emitter. Water traveling through irrigation lines experiences pressure loss due to friction. As water moves through pipes, friction against the side walls creates turbulence and causes a drop in pressure. The faster the water travels, the more friction is created against the walls of the pipe, reducing pressure in the lines. Small diameter pipes with a high surface-to-area ratio, will have a greater negative impact on water pressure than large diameter pipes. Distance exacerbates the pressure loss. By comparison, large pipes have small inside surface to area ratios, water moves at slower velocities, lessoning friction. Use the largest diameter pipes possible for the operation (depending on pumping capacity) to reduce pressure loss due to water velocity and friction. However, for an existing system, the following strategies will improve the efficiency of water application.

Check operating pressures. Pressure gauges placed strategically along the irrigation system, from the pump, along mains and down laterals will show if pressure loss is an issue. Emitters, including drip, spray, or rotating sprayers are designed to operate within specific pressure parameters to apply water efficiently and evenly. Pressures, higher or lower than those specified by the emitters will cause imbalances within the system. Improper pressure at the pump, loss of pressure down the line from friction or old, worn out or clogged emitters, will cause your irrigation uniformity to decrease. Sprayers operating at lower-than-specified pressures will not distribute water evenly because water droplets will be too large and will not be thrown uniformly. At higher than specified pressures, water droplets become too fine and are subject to wind and evaporation. Since you need to make sure all plants have enough irrigation, this inconsistency may result in over application of water for some plants and under application of water for others. At the correct specified pressure, sprayers will throw water droplets of the correct size, which can be distributed uniformly.

Even if proper operating pressures are achieved, are the emitters, nozzels, and sprayers worn, clogged or corroded? A new emitter has a specific diameter aperture. In time, that aperture may wear or clog, changing the pressure needed to apply a specific volume at a specified distance. An old trick is to have a drill bit the same diameter of the emitter aperture. Dropping the bit into the aperture may quickly reveal a problem.

There are two tests that can be performed to determine application uniformity. Both the Lower Quarter Distribution Uniformity Test (DU_{LQ}) and the Christiansen's Uniformity Coefficient are easy methods to find inefficiencies and correct them.

The DU_{LQ} is a simple test by which you place "catch cans" or containers to hold the water from your emitters during a test irrigation run. Use at least sixteen containers placed either randomly throughout the system or within a specific block area. Turn the irrigation on for a set amount of time. Collect the water samples, measuring the volume applied in each of the containers, while noting where each container is located. Draw a schematic of your design, mapping where you placed your containers. You will need this to determine where you may be having problems down your irrigation line. On your map, label each container position and the volume of water in each container. Lastly, write the volumes down in a list from highest to lowest. Get an average of all the volumes. At the bottom of the list will be the containers with the lowest volumes recorded. Take the lowest 25% of the volumes. That is, if you have 16 containers, take the four (25%) with the lowest volumes and average those volumes. Divide the average of the lowest volumes over the average of all the volumes. If that divided value is less than 80%, (90% for drip or microirrigation) then your "lowest quarter uniformity" is too low and your system is not functioning as efficiently as it should. You are probably overwatering too many of your plants just to get other plants irrigated. Perform this test throughout your irrigation system. With the schematic map you make, you can find problem areas and correct.

The Christiansen's UC is an overall examination of an irrigation system. Use the same data from the DU_{LQ}, calculating the overall average, and subtract the average from all of the values. Make all the values positive numbers (absolute values). Total these "deviation values" and average them. Follow the formula below.

UC=100% [1 – (Average deviation from the average volume of application / Overall average volume of Application)]

For high value shallow rooted or containerized crops, the UC value should be more than 87%. For field crops the UC should be higher than 81% and for deep rooted orchard crops, the value should be greater than 72%

For hand watering, train employees to irrigate as consistently as possible. Check containers after irrigation to see if the water being applied is thoroughly wetting the substrate in the container. Often, dry root balls are found in a container, even after what seems to be a thorough hand watering. Regardless of application method, try to keep the substrate moist, which may mean several irrigation events a day. This is considered cyclic irrigation or several short irrigation events which keep substrates or soils moist and prevents them from turning hydrophobic (resisting moisture). A hydrophobic substrate takes over twice the volume of water for rewetting, most of which channels down the side of the pot or through the substrate, increasing your leaching fraction and wasting fertilizer and water.

For those watering by hand, especially if you are applying nutrients through your irrigation water, there are two management practices that are vital for increasing efficiency. First, keep track of your leaching fraction. This is a best management practice, regardless if you are hand-watering or not. Leaching fraction is the fraction of applied water that runs through the pot. With that water, go nutrients. Minimize your leaching fraction to less than 15%. Secondly, make sure your fertilizer injector is calibrated, regardless if it is an expensive displacement pump injector or a simple aspirator injector like a Hozon™. Verify the rate at which fertilizer concentrate is mixed with irrigation water, by measuring the volume of your irrigation application and the volume being taken up by the injector. The ratio between the two volumes is your rate. If different than what you expected, adjust your fertilizer concentrations. You can also use electrical conductivity (EC) of your fertigation water to determine how accurate your injector is working. The fertilizer bag should give you the EC based on the concentration of nitrogen you are applying. For more information, read our fact sheet here.

Check Mondo Grass and Liriope for Scale

By: Stanton Gill

A lot of herbaceous plant material is being shipped into Maryland from the south this month. Be sure to examine mondo grass and liriope for presence of fern scale, *Pinnaspis aspidistrae.* One of the alert perennial growers picked up this scale on mondo grass, *Ophiopogan*, plants this week. We found mainly 3rd instar females. These females are loaded with eggs and crawlers will move up onto the newly emerging growth over the next couple of weeks.

Control: Altus systemic works well on this scale.

A settled crawler and a third instar female of fern scale were found on mondo grass

Fungus Gnat Populations High This Week

By: Stanton Gill

The cloud cover last week and wet weather made conditions ideal for fungus gnat populations to shoot up in greenhouse growing areas. Fungus gnats are more than a nuisance. They may also present real problems in plant production. Fungus gnats actively transmit fungal spores from diseased plants to healthy plants. Fungus gnat larvae feeding can cause damage to plant growth and spread diseases such as fusarium, pythium and other soil-borne diseases.

Fungus gnat larva feeding on pansy

Fungus gnat adults are flies approximately 1/8 inches long with long legs and long, thread-like antennae. The adults are generally found near the surface of the soil or potting medium. They are weak fliers, so they do not wander far when flying. However, they can spread with plant material and growing media. The larvae feed on fungi and decaying plant material in the potting medium. Heavy populations of fungus gnat larvae can also feed on plant roots and be quite devastating to rooted cuttings.

Cultural control methods

Avoid overwatering plants since fungus gnats require moist to very moist soil or substrate for development. Potting media should be stored dry, and pots and production areas must be well-drained. Fungus gnats can exist on soil, fungi and algae on and under benches. Periodically inspect developing callus and roots for larvae, and monitor adult populations by placing yellow sticky cards several inches above the plant canopy throughout the crop.

Biological and chemical control tactics

Compatibility between biological control organisms and other plant protection products must be carefully planned according to cropping systems, environmental conditions, previous chemical applications and rotations, and the pest history on specific crops or in greenhouses.

There are several biological control materials that control fungus gnats and are compatible with chemical controls. The entomopathgenic nematode, *Steinernema feltiae*, will infect the larval stage of the fungus gnat when applied to the growing media. *S. feltiae* can be applied anytime during the crop cycle. The predatory mite, *Hypoaspis miles*, and the rove beetle, *Atheta coriara*, also work well to control fungus gnat larvae.

If fungus gnat larvae are detected or adult populations are starting to increase, apply an insect growth regulator as a drench. Pyrethroid sprays can be used to control adults and can be applied as needed once the mist cycle is reduced to the point that allows the foliage periodic intervals of drying. The pyrethroids are not compatible with biological releases.

Aphids - Watch Out

By: Stanton Gill

With the warm weather, aphid populations have reached the "explosive stage" of the season. **Check aphid-prone plants such as ornamental peppers, salvia, tomatoes, lantana, snapdragons, impatiens, and fuchsia.** All of these plants are magnets for aphids. Growers need to monitor closely for aphids at this time of year especially in aphid prone plant material. This week's warm weather is waking up the aphid population. Look for the white cast skins on the foliage and the presence of honeydew. Most scouts use a clipboard to tap foliage onto the clipboard and look for aphids on the board.

Monitor for aphids before populations get out of control

Many growers push their plants to maximize growth with ammonia forms of nitrogen at this time of year to get crops quickly out the door. This practice serves to increase the birth rate (increased fecundity) of aphids since they benefit from the higher nitrogen levels.

We have several good material for aphid control. Stylet blockers such as Endeavor and Aria are good materials to be use on aphids if you are using them to suppress a population until your biological control such as *Aphdius* wasps kicks in.

Microbial Insecticides

Fungus-based and bacterial products offer a little softer control options. They often involve multiple applications and are generally slower than traditional chemistries.

BotaniGard 22WP/BotaniGard ES/Mycotrol ESO/ Mycotrol WPO (UN) is an option we have used successfully. You must apply it with a fine mist application to make contact with the aphids. The good part is the label has many edible plants listed, which is the hot selling item right now. Requires three spray applications at three- to five-day intervals. Best tank-mixed with Azatin 0, Azaguard, or Molt-X.

These aphid mummies indicate that the parasitic wasp, *Aphidius* sp., is active in the greenhouse

BotaniGard WP offers greater plant and biological control agent (BCA) safety compared to the ES formulation. Mycotrol ESO and Mycotrol WPO are OMRI-listed.
Grandevo PTO (UN) – Label includes many edibles. Weekly spray applications at first sign of aphids continue for three weeks. OMRI-listed.

Other Choices
Aphids can develop resistance, so it is a good idea to rotate between classes if using chemical control. Fortunately, there are several options. The IRAC chemical class is listed in ( ) so you can rotate between classes.

Aria (9C) is a stylet feeding blocker and is translaminar so spraying on top of the leaf it travels to the bottom of the leaf and gives control for four weeks.
Endeavor (9B), like Aria, is also a stylet feeding blocker. It has up to three-week residual.
Enstar AQ (7A) –is an insect growth regulator (called IGR class) and interrupts aphid skin shedding process and prevents maturation. May burn some blooms.
Fulfill (9B) is a feeding blocker. Label includes many edibles and last up to three-week residual.
M-Pede (UN) is a purely contact control only. It has been known to burn blooms or tender growth. Often mixed with Azatin O, Azaguard, or Molt-X for best control. OMRI (Organic Materials Review Institute)-listed.
Rycar (UN) is contact and translaminar.
TriStar (4A) –is a contact and translaminar material with good bloom and plant safety.

New IPMnet Website

University of Maryland Extension is making changes to its website so the look of the IPMnet site will be different. URLs will be new, too. We will post the new link in a future report. The change is scheduled to take place in early April.