Vegetable Crops Hotline

A newsletter for commercial vegetable growers prepared by the Purdue University Cooperative Extension Service

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No. 552
May 25, 2012

<http://www.btny.purdue.edu/pubs/vegcrop>

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Spider Mites on Watermelon - *(Rick Foster and Dan Egel)* - Spider mites have been observed in southwestern Indiana on watermelon. Normally, spider mites are observed later in the season when the weather is hot and dry. However, the recent spring weather has been hotter and dryer than normal. This article will review management recommendations for spider mites.

Recent observations of spider mites have been on watermelon seedlings with just a few true leaves. These leaves may be recognized by the chlorotic (yellow) coloring (Figure 1). The spider mites feed on the underside of such leaves; the webbing the spider mites weave collects sand and dust as can be seen in Figure 2.

Figure 1: Early season damage due to spider mites may appear chlorotic (yellow) on the upper side of the leaf. *(Photo by Dan Egel)*

Figure 2: The underside of leaves affected by spider mites often collects sand and other debris because of the webbing that spider mites weave. *(Photo by Dan Egel)*

Two-spotted spider mites sometimes will affect muskmelons or cucumbers, but are most commonly a problem on watermelons. Mites cause damage by sucking sap from the underside of leaves. Affected leaves often have a chlorotic (yellow) appearance between the veins. In hot, dry weather, mites can rapidly increase in numbers, as much as 70X in a week. In addition, hot, dry weather causes the mites to eat more and dry soil conditions provide the mites with more concentrated food, resulting in more rapid reproduction. Watermelon plants that are not irrigated are particularly susceptible to mites because the mites increase faster and eat more and the plants may already be drought stressed.

Mite feeding can cause plants to be defoliated within a couple of weeks or can cause fruit to be of such poor quality that they are unmarketable. In some cases, mites will also feed on the rind, giving it a sandpaper-like texture.

To monitor for mites, you can either use a 10X hand lens and look for the mites on the underside of leaves or shake leaves over a white sheet of paper and watch the mites crawl on the paper. Look first on the edges of fields. If there is a gravel road next to the field that produces dust that lands on the plants, look there first since dust increases mite populations. Be aware that mite populations are frequently localized, so you may not need to treat the entire field. If you don't treat the whole field, be sure to spray at least 100 feet beyond the existing infestation to make sure that you contain the mites. We don't have a specific threshold for spraying mites on watermelons. Stressed plants on non-irrigated land will be able to tolerate far fewer mites than healthy plants on irrigated land.

There are several miticide choices listed in the *Midwest Vegetable Production Guide for Commercial Growers (ID-56)* **http://www.btny.purdue.edu/Pubs/ID/ID-56/**. Two excellent choices are Agri-Mek® and Oberon®.

Tomato Pith Necrosis - *(Dan Egel)* - This disease has been observed in southwest Indiana. Although this disease is not frequently observed, is seems to be increasing in incidence. Tomato growers should be aware of this disease and be able to distinguish pith necrosis from other diseases.

Often the first symptom observed is a chlorosis (yellowing) of young leaves. It might be possible to observe stems which appear shriveled (Figure 3) This may be associated with a dark brown necrosis of the lower stem and rotten pith (Figure 4). Low night temperatures, high nitrogen levels and high humidity favor the bacterium that causes pith necrosis. Therefore, it is usually seen in a greenhouse situation. The only management recommendation is to avoid high nitrogen levels in tomato plants as well as high humidity. Vent the greenhouse in the evening to let in drier air before closing up he house. Space plants to maximize air movement around plants. Indeterminant plants can have the lower leaves pruned off as production moves up the plant.

Figure 3: The stems of tomatoes affected by pith necrosis may appear shriveled compared to healthy stems. *(Photo by Dan Egel)*

Figure 4: Tomato pith necrosis may cause brown lesions on the exterior of the stem and the pith to become rotten. *(Photo by Dan Egel)*

How to Calculate How Long to Run Drip Irrigation - *(Liz Maynard)* - Drip irrigation has a number of advantages in vegetable production. It is an efficient use of water. Wetting of crop foliage and fruit is avoided. This reduces the risk of certain plant diseases. For many crops, this also reduces the risk that human pathogens in water will be transferred to the harvested part of the crop. It's usually possible to continue fieldwork during irrigation. Soluble fertilizers and other ag chemicals can be applied to the crop root zone using an injector, with a backflow preventer installed to protect the water supply.

Many new users of drip irrigation have questions about when to irrigate and how long to run the irrigation. This article will address the question of 'how long.' It is an important question because watering for too long is likely to wet the soil well below the root zone of the crop, wasting water and leaching nutrients too deep in the soil for the crop to reach them.

How many minutes or hours to run a drip irrigation system depends on 1) the flow rate of the system, and 2) how much water is needed.

The flow rate of the system will depend on the particular type of drip tape used and the water pressure. Manufacturer specifications typically provide flow rates in gallons per minute per 100 ft. of drip tape at the recommended operating pressure. If it is more convenient to think in terms of gallons per hour per 100 ft. of drip tape, just multiply gallons per minute by 60. This flow rate provides an estimate of how much is actually delivered. If there are leaks, or if the system is operated below the recommended pressure, the actual amount will be less. It is a good idea to check the actual flow rate periodically.

One answer to the question 'How much water is needed?' is 'Enough to replace the amount taken up by plants and evaporated from the soil surface since the last irrigation.' A common rule of thumb is that a crop at full growth in the middle of the summer uses 1 to 1.5 inches of water per week, or 0.14 to 0.21 inches per day. Less water is used by a crop in the early or late stages of growth, in cool and cloudy weather, when winds are calm, and when humidity is high.

To convert 'inches of water' to 'gallons' use the information that 1 acre-inch of water = 27,154 gallons. For example, if one acre of a crop uses 1 inch of water per week, it uses 27,154 gallons per week, or 3,879 gallons per acre each day.

How many hours will it take to apply 3,879 gallons per acre with drip tape? The answer depends on the spacing between drip tape lines. If drip lines are 5 feet apart, the length of drip tape in an acre is 8,712 ft. The daily amount of 3,879 gallons per acre is equivalent to 45 gallons per 100 ft. of drip tape. If a drip tape with a flow rate of 25 gallons per hour per 100 ft. of tape is used, it will take 1.8 hours, or 1 hour and 48 minutes.

For different spacings between drip lines, see Table 1 to convert acre-inches to gallons per 100 ft. of tape. Drip tape suppliers often include similar tables with their product information. Then use Table 2 to determine how long it will take to apply that many gallons depending on the flow rate of the tape. Or, use the formula in the next column to calculate how long to run the irrigation.

In the following formula:
T=hours to run the drip tape
I = desired amount of water, in inches of water per acre
R = distance between drip lines, in feet.
F=flow rate of drip tape, in gallons per hour per 100 ft. of tape
Note that I X 62.3 X R = Gallons per 100 ft. of drip tape.

$$T = \frac{I \times 62.3 \times R}{F}$$

To get a better estimate of water use based on actual weather conditions, growers can use reference evapotranspiration (ref ET). Evapotranspiration is the combined loss of water by evaporation from the soil surface and transpiration through plant leaves. Ref ET is the theoretical amount of water used by a hypothetical solid stand of grass. It can be calculated from weather data. Crop water use can be estimated by multiplying the ref ET by a correction factor, or 'crop coefficient' specific to the crop and its growth stage. At full growth, the crop coefficient for most crops is close to 1, meaning water use is close to the value calculated for ref ET.

Table 1: Gallons per 100 ft. of drip line required to provide the desired volume of water (acre-inches) for drip lines at spacings from 2 to 10 ft.

Desired Volume of Water	Distance Between Evenly-Spaced Drip Lines (ft.)							
(acre-inch)	2	3	4	5	6	7	8	10
	gallons per 100 ft. of drip line							
0.10	12	19	25	31	37	44	50	62
0.20	25	37	50	62	75	87	100	125
0.25	31	47	62	78	93	109	125	156

Table 2: Hours required to apply desired volume of water (gallons per 100 ft.) for drip tapes with flow rates from 24 to 60 gallons per hour per 100 ft. of tape.

Flow Rate of Drip Tape		Desired Volume of Water (gallons per 100 ft.)				
Gallons per Hour per 100 ft.	Gallons per Minute per 100 ft.	20	40	60	80	100
		hours				
24	0.4	0.8	1.7	2.5	3.3	4.2
36	0.6	0.6	1.1	1.7	2.2	2.8
48	0.8	0.4	0.8	1.3	1.7	2.1
60	1.0	0.3	0.7	1.0	1.3	1.7

Before the crop is full grown, the crop coefficient will be less than 1-- estimates vary from 0.3 for sweet corn to 0.7 for many other vegetable crops.

The Indiana State Climate office calculates ref ET daily during the growing season for Purdue Ag Centers around Indiana. The ref ET values are posted online, along with other weather data. To find them, go to **iclimate.org**, choose ‘Data’ and then ‘Daily – Purdue Automated’ from the drop-down menu. Follow instructions on screen to select the date range, weather station(s), and report format.

As an example of how ref ET varies over the growing season, see Figure 5. This graph shows the daily ref ET estimated for Pinney-Purdue Ag Center from early June through mid-September, 2011. During the hot period in July 2011, ref ET was generally between 0.15 and 0.20 inches, and during the rest of the season it was generally between 0.10 and 0.15 inches. This corresponds well to the ‘rule of thumb’ for water use by full-grown crop in mid-summer mentioned above.

So, we return to the question at the beginning of this article: how long should drip irrigation be run? Use the ‘rule of thumb’, or data from iclimate.org, and observations of crop growth stage, to estimate how much evapotranspiration has occurred since the last irrigation. Take into account rainfall by subtracting inches of rain since the last irrigation from the estimate of evapotranspiration. Use Tables 1 and 2, or the formula, to convert the evapotranspiration into how much water is needed per 100 ft. of row, and how long to run the irrigation. After irrigating, check near the drip tape with a soil probe to see how deep the soil is wet. If the soil is wet several inches below the root zone, adjust your estimates to apply less water next time. If the water did not get deep enough, adjust to apply more water next time. Keep records so that over time experience will lead to more efficient water use.

Figure 5: Daily Reference Evapotranspiration (inches) from June 10 through Sept. 15, 2011 for Pinney Purdue Ag Center, Wanatah, Indiana. From data provided by the Indiana State Climate Office, **iclimate.org**.