VEGETABLE CROPS HOTLINE

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

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In This Issue

Cracking Tomatoes

(Wenjing Guan, guan40@purdue.edu, (812) 886-0198)

Tomatoes cracking in the late stages of ripening (Figure 1) was observed in our field visit. This article discusses conditions that are likely to predispose tomatoes to crack.

Figure 1. A cracking tomato

The cracking that happened recently in open field production is likely associated with the heavy rains. The problem is most observed when a dry period is followed by heavy rains. The change from low to high soil moisture reduced the tomato skin strength, and as the fruit expanded quickly, cracking occurred. High soil moisture due to rains and overhead irrigation is even more likely to cause fruit cracking than drip irrigation. This is because water can directly enter the fruit through tiny cracks that may have occurred before large cracks become visible. High temperature and high light also predispose tomatoes to cracking. This is because rising temperatures of fruit pulp increase the pressure on the skin while it also decreases skin strength.

Cracking is not confined to tomatoes growing in open-field; it happens on tomatoes growing in high tunnels and greenhouses, in spite of the fact that soil moisture is often maintained at a more consistent level under protected production. High relative humidity is one of the reasons that may predispose fruit to crack in greenhouses. Transpiration is high under low relative humidity, thus water may move back from fruit to leaves. But this is unlikely to happen when relative humidity is high and when soil is moist. So when water pressures increase in fruit because of temperature increase or an increase in water supply, the skin is exposed to high internal pressure that may eventually cause cracking. Applying shading to the tunnels can reduce fruit cracking as well as other high-temperature-related tomato disorders, such as yellow shoulder and blotchy ripening. However, be aware that shading reduces the light intensity, over-applying or applying shading for an extended period decreases photosynthesis that can negatively affect yield and quality.

Growers note that cracking rarely happens on small-sized tomatoes. It is true that fruit size makes a difference. As fruit increases in size, physical stresses on skins increase that predispose fruit to cracking. Another interesting observation is that cracking is more likely to happen on plants that have a smaller number of fruit. Because of the lack of competition for carbohydrates and water, those fruits often grow rapidly and that increases the chance to crack.

Cultivar differences in susceptibility to cracking clearly exist. From a plant physiology standpoint, the tolerant cultivars may have tougher skin at the turning stage or smaller fruit size. It could also be because of plant architecture, for example, more vegetative growth that shades the fruit.

Cracking reduces fruit marketability and makes them prone to rot. One last piece of information, hoping to make growers who are struggling with the tomato cracking issues feel a little better, cracked tomatoes often have high soluble-solids content. Water tends to move from an area of plant that has a lower sugar concentration to a higher concentration. Thus, the higher the fruit sugar concentration, the greater tendency that water moves into the fruit that increases pressure to the skin.

Foliar Diseases of Tomato

(Dan Egel, egel@purdue.edu, (812) 886-0198)

Listed below are select foliar diseases of tomato.

Early blight and Septoria leaf blight-These diseases are listed together because, from a few paces away, the diseases appear similar. And the management for these diseases is similar. Together these diseases are probably the most common diseases of tomatoes in the field. One of the most common complaints I get about tomatoes is something like this…..'my tomatoes are turning brown from the ground up'. The most likely cause of this complaint is one of these diseases.

Early blight causes relatively large round necrotic lesions with concentric rings (Figure 1). The lesions tend to be gray-brown and are, as mentioned above, more common on the lower leaves of the plant. Septoria leaf blight lesions are also round but lack concentric rings. In addition, Septoria lesions have small, dark fungal structures in the lesions which may be seen with a 10X hand lens (Figure 2). Both diseases usually cause the lower leaves of the plant to become necrotic since older leaves tend to be more susceptible to these diseases.

Figure 1. Early blight of tomato.

Figure 2. Septoria leaf blight of tomato.

Crop rotations of 3 to 4 years and fall tillage are important management decisions for both diseases. Currently, no commercial varieties have resistance to Septoria leaf blight. However, there are a few varieties with resistance to Early blight. Fungicides that are likely to be effective against these diseases are listed in the *MW Vegetable Production Guide* **mwveguide.org**. Contact products include fungicides with the active ingredient chlorothalonil (e.g., Bravo®, Echo®, Equus®, Initiate®) and mancozeb (e.g., Dithane®, Manzate®, Penncozeb®). Systemic fungicides include Aprovia Top®, Cabrio®, Fontelis®, Inspire Super®, Luna®, Priaxor®, Quadris®, Revus Top®, Rhyme®, Tanos® and Zing®. See the *MW Vegetable Guide* for details on rates, application instructions and formulation differences. Organic growers may find that fungicides that contain the active ingredient copper may help to reduce disease severity.

Bacterial spot of tomato has been observed across Indiana this summer. Leaf spots are usually 1/16 inch, and dark. Where lesions are numerous upon a leaf, the tissue may be chlorotic (yellow) (Figure 3). In contrast, each lesion of bacterial speck is often accompanied by chlorosis whether lesions are numerous or not. Lesions of bacterial spot on fruit are dark, raised and up to 1/3 inch in diameter. The disease prefers warm, wet weather. Overhead irrigation will also spread this disease.

Figure 3. Bacterial spot of tomato.

Bacterial spot is much more common in field tomatoes than in greenhouse or high tunnel tomatoes. This is because bacterial spot requires leaf wetness for infection to take place and rain to spread the bacteria from leaf to leaf and from plant to plant. For the most part, tomato plants under cover lack sufficient leaf wetness to allow bacterial spot to become a problem.

You may have heard about bacterial spot of pepper and pumpkin. Bacterial spot of pepper is closely related and may be able to affect tomato. Bacterial spot of pumpkin will not affect pepper or tomato.

Successful management of bacterial spot will take a combination of cultural and pesticide treatments. Since bacterial spot may be seed borne; the disease may have been brought in on your seed/transplants. However, the causal bacterium also survives on crop residue. Tomatoes should be rotated 2 to 3 years away from peppers or tomatoes. Treatment with copper hydroxide may reduce spread in the field. Some strains of the bacterial spot pathogen are resistant to copper products. In a recent Purdue University study in 2016 and 2017, 84% of bacterial spot strains collected were copper insensitive (resistant). To increase the amount of copper available on the leaf, copper products may be mixed with fungicides with the active ingredient mancozeb (e.g., Dithane®, Manzate®, Penncozeb®). Many copper products may be used in some organic schemes.

Streptomycin products are labeled for use on tomatoes only in the transplant greenhouse (e.g., Agri-mycin®, Harbour®). The survey mentioned above found that 58% of bacterial spot strains were insensitive to streptomycin. So, it makes sense to treat with a streptomycin in the transplant greenhouse before going to the field.

Products with the active ingredient hydrogen dioxide (e.g., Oxidate®) are also labeled for bacterial spot in the field and greenhouse. Hydrogen dioxide can kill bacteria on contact, however, it has very little to no residual. Do not substitute hydrogen dioxide for copper, streptomycin or Actigard®. Be careful when mixing Oxidate® with other products. When used with copper products, for example, Oxidate® may not mix well. Read the labels of all the products carefully. Oxidate® may be used in some organic schemes.

Another product that has been used for management of bacterial spot of tomato is acibenzolar-S-methyl (trade name Actigard®). ASM is known as a systemic acquired resistance product. That is, it 'tells' the plant to turn on biochemical pathways that defend the plant from infection. ASM has been used with copper products to lessen the severity of bacterial spot of tomato. However, ASM can cause yield loss if used on tomatoes that are stressed due to drought or other environmental factors. The product Lifegard® has a similar mode of action to Actigard®. Serenade Opti® (an older name for this product is Serenade Max®) is labeled against bacterial spot of tomato. The action of Serenade Opti® is reported to be due to a protein component of the bacterial ingredient and to a systemic acquired resistance activity similar to that described for ASM. Both Lifegard® and Serenade Opti® may be accepted for some organic certifications.

Powdery mildew of tomato is not usually a common problem in Indiana. However, in recent years, there have been more reports of this disease than usual. Powdery mildew is more often observed in a greenhouse or high tunnel situation than in a field.

The key symptoms of this disease are the talc-like lesions on the upper and lower leaf surfaces (Figure 4). It is important to note that the location of the upper and lower lesions do not correspond with each other. When the lesions are young, it may almost seem as if the lesions can be 'wiped off'.

Figure 4. Powdery mildew of tomato.

Few varieties exist with good levels of host resistance, although growers may notice some difference in susceptibility between varieties.

It may not be necessary to treat tomatoes affected with powdery mildew with fungicides. If fungicide treatment appears to be warranted, a few alternatives are: Fontelis®, Inspire Super®, Quadris Top®, several formulations of sulfur, Switch® and Vivando®. The products listed are all either labeled for the greenhouse or silent about greenhouse use. Check the label carefully before using any of these products.

Considerations when Selecting the Right Miticide

(Laura Ingwell, lingwell@purdue.edu, (765) 494-6167)

Sometimes choosing the right product to manage a particular pest can be a daunting and risky task, especially when crops are close to harvest and an imposing outbreak sneaks up on you. One such pest that is sneaky are two-spotted spider mites (*Tetranychus urticae*; Figure 1). This microscopic pest can hang out in the crop or neighboring habitat and go unnoticed for a long time, just waiting for the perfect combination of crop growth stage and environmental conditions when it will explode in numbers and become a noticeable threat to the crop.

Figure 1. Adult two-spotted spider mites are distinguished by the two black dots on the dorsal side of their body. Their eggs are small and translucent and can be seen in the figure as well. (Photo by John Obermeyer.)

Here are the facts on spider mites. They have a wide host range, meaning they feed on more than 20 different species of plants. This makes limiting host plant availability as a means of control impossible. They can withstand a variety of environmental conditions and overwinter in sheltered environments in our region (greenhouses, high tunnel, etc.). Their main mechanism of dispersal is on the wind. Eggs are laid on fine silk webbing and under high populations this webbing resembles those produced by spiders, hence the common name. Depending on the environment, they can complete their life cycle in 5-20 days. Generally, the warmer it is the faster they develop. This rapid life cycle leads to an increase in the potential to develop resistance to pesticides applied to manage this pest. Mites feed on the plant at the cellular level, removing photosynthates and creating a stippling pattern on the leaves. This looks like white/yellow speckles on the upper surface of the leaves and on the underside you will see the pest and webbing (Figure 2).

Figure 2. Spider mite damage often causes interveinal chlorosis on older leaves and may be mistaken for a nutritional problem. (Photo by Dan Egel)

The mites thrive in hot and dry weather, and therefore many of you may be noticing them in your crops beginning in July. There are a variety of products available for use to manage

this pest, and careful consideration should be made. Below I will discuss four common products that are used in conventional production of cucurbit crops.

Oberon® (spiromesifen) is a contact pesticide effective against all development stages, however juveniles are more susceptible than adults. This product belongs to group 23 insecticides, according to the insecticide resistance action committee (IRAC) mode of action designation. Group 23 are growth inhibitors specifically preventing lipid biosynthesis leading to death. This is why adults are less susceptible, they are not growing nearly as much as the immature stages of this pest. Growth inhibitors can be slow acting; you should wait 4-10 days to evaluate mortality following the application. Thorough coverage is key.

Portal® (fenpyroximate) is a group 21A insecticide. It controls all mobile stages of mites by inhibiting cellular respiration in the mitochondrion of cells resulting in rapid cessation of all biological activities including feeding and reproduction. Feeding stops immediately after application and mortality can be observed within 3-7 days.

Zeal® (etoxale) is a group 10B insecticide, interrupting the production of chitin which is the substance that constitutes the exoskeleton of the pest. It is a growth inhibitor, like spiromesifen, but disrupting a different aspect of the growth process. It is predominately an ovicide (kills eggs) and larvicide (kills immatures). No more than one application per season and 3.0 oz per acre are allowed. Coverage is essential for good control and the water volume in the mix should be increased when making applications to mature plants or those with more compact foliage. Like group 23 products, group 10B is slow acting because it is interrupting development, i.e. progression into the next development stage is disrupted.

Agri-mek® (abamectin) is a group 6 insecticide. Products belonging to this group target nerves and muscles in the insect causing paralysis. This mode is generally fast acting, and you can see results in a short amount of time. Thorough spray coverage is key. Group 6 products are highly toxic to bees and should not be applied during bloom. An adjuvant must be used with application to avoid illegal crop residues.

Be sure to scout your crop and evaluate the level of infestation, development stage of the pest and progress of the crop when choosing a miticide. As always, follow the label directions for whichever product you choose; the label is the law.

Soybean Assessment After Wet Conditions

(Wenjing Guan, guan40@purdue.edu, (812) 886-0198)

Our recent field visit revealed a green bean issue that is likely associated with wet conditions. Purdue soybean specialist Shaun Casteel recently released this video that may also help vegetable bean growers to assess the damage. https://www.youtube.com/watch?v=IMfoghn7Ilk

First Time Indiana is Drought Free Since Early June 2020

(Beth Hall, hall556@purdue.edu)

It is amazing to think that some part of Indiana has been in at least the *Abnormally Dry* category of drought on the US Drought Monitor for over a year. While it has not always been the same parts of the state, certainly northern Indiana has been the most consistently dry. Recently, however, the state has been in a wet pattern, helping to relieve most precipitation deficits. It seems when one half of the United States (US) is in a rather stagnant weather pattern, the other half experiences the opposite. Unfortunately, the western half of the US has been extraordinarily warm and dry. This is due to a blocking high pressure system that is forcing the jet stream to maintain a rather consistent pattern that encourages relatively cooler and wetter conditions in the eastern half of the country. Should that blocking high break apart or weaken, Indiana will likely see more typical transitions between wet and dry groups of days. It is possible that the weather patterns will shift and Indiana will be in an extended drier phase, but there are no strong indications at this time that an extended dry period will occur any time soon.

The latest climate outlook for the rest of July has too much uncertainty for most of Indiana with respect to temperature (i.e., climate models are favoring neither above- nor below-normal temperatures for the rest of the month). Precipitation for the rest of July is also not favoring abnormally wet or dry conditions with the exception of southeastern Indiana that has slightly enhanced chances for wetter-than-normal conditions.

The three-month climate outlook – representing August-October – has equal chances for above, below, and normal precipitation amounts (Figure 1). However, there are enhanced chances for above-normal temperatures during this extended period (Figure 2). If the temperature outlook comes to fruition, that would imply increased evapotranspiration rates that could lead to abnormally dry or

even moderate drought conditions depending upon the timing of any precipitation events.

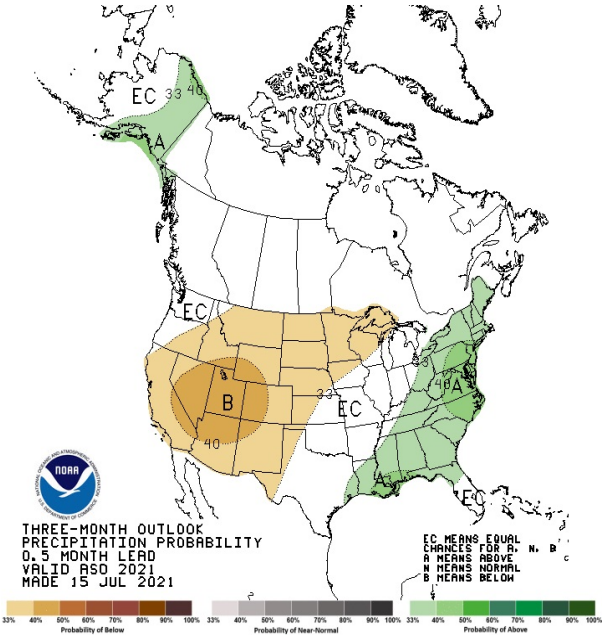

Figure 1. National three-month climate outlook of precipitation relative to normal for August through September (source: Climate Prediction Center).

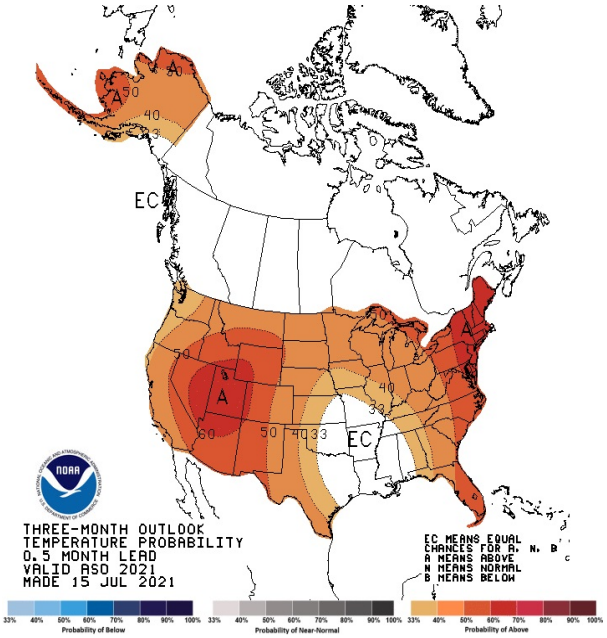

Figure 2. National three-month climate outlook of temperature relative to normal for August through September (source: Climate Prediction Center).

Modified growing degree-day accumulations now range from about 1300 to 1800 units across the state, with higher amounts to the south (Figure 3). From a climatological perspective, those amounts are slightly below normal across southern Indiana and slightly above normal for Indiana's northernmost counties. However, departures are rarely greater than 100 units. Figure 4 illustrates the accumulation of MGDDs from April 1 through July 14th of this year compared to the most recent four years.

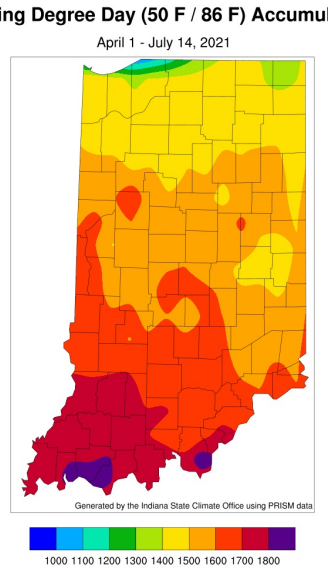

Figure 3. Modified growing degree day accumulations from April 1 to July 14, 2021.

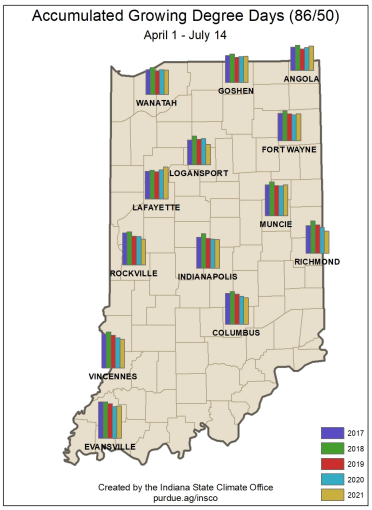

Figure 4. Comparison of 2021 modified growing degree day accumulations from April 1 – July 14 to the past four years.

August 10 Vegetable Twilight Meeting at Pinney Purdue

Join Purdue Extension at the Pinney Purdue Ag Center near Wanatah on Tuesday, August 10, 2021, 5:00 to 8:00 p.m. Central Time, to tour vegetable research trials and learn about vegetable production on farms and in gardens.

Topics to be covered include weed management in pumpkins; compost and soil health management for pepper production; no-till sweet corn and pumpkin after winter rye; two-spotted spider mite management in high tunnels; organic sweet potato production; cover crops, soil fertility, and compost for the home garden; and winter squash varieties, culture, and use. Equipment used in the research

plots will be on display, including a walk-behind tractor and implements.

Get your questions answered at the Q&A session with presenters after the plot tours. Stay on after 7:00 p.m. for dinner and networking. Pinney Purdue Ag Center is located at 11402 S. County Line Rd., Wanatah, Indiana.

There is no charge for attendance, but please register by Friday, August 6. Register online at https://purdue.ca1.qualtrics.com/jfe/form/SV_eJweE5jdsWnTLhQ To register by phone, or if you have other questions, please contact Nikky Witkowski, (219) 365-3555 or nikky@purdue.edu.

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