VEGETABLE CROPS HOTLINE

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

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IN THIS ISSUE

ANTHRACNOSE OF CUCUMBER - *(Dan Egel and Tom Creswell)* - Anthracnose of cucurbits primarily affects cucumber, muskmelon and watermelon. In Indiana, two races of the fungus that causes anthracnose of cucurbits have been observed. Cucumber anthracnose is caused by race 1 of the fungus; watermelon anthracnose is caused by race 2; muskmelon may be affected by either race 1 or 2. Only cucumber anthracnose has been observed in Indiana this year.

The symptoms of cucumber anthracnose include light brown necrotic lesions as large as ½ inch in diameter (see Figure 1). These lesions may have concentric rings or ridges. Under moist conditions the lesions may appear orange or salmon colored. Although the lesions are round, the margins of the lesions may appear jagged or serrated. Severe disease outbreaks may include pitted lesions on the cucumber fruit. Additional photos of this disease may be found at the Picture of the Week on the Purdue University Plant and Pest Diagnostic Laboratory webpage **http://www.ppdl.purdue.edu/PPDL/weeklypics/7-18-11.html**.

Anthracnose is favored by warm, rainy weather. Leaf wetness is required for infection and splashing water spreads the spores from plant to plant. Heavy dews and overhead irrigation can increase disease severity.

Rotation with non-cucurbit crops may help to reduce the severity of anthracnose. Host resistance to this disease exists-growers should seek varieties with resistance to race 1. Fungicides recommended to manage cucumber anthracnose may be found in the *Midwest Vegetable Production Guide for Commercial Growers* 2011 **http://www.btny.purdue.edu/Pubs/ID/ID-56/**. In brief, products with the active ingredient chlorothalonil (e.g., Bravo®, Echo®, Equus®) or mancozeb (e.g., Dithane®, Manzate®, Penncozeb®) are contact products which should have good efficacy for anthracnose. Systemic products that have performed well recently include Inspire Super®, Pristine® and Quadris®.

More information about cucurbit anthracnose can be found in the Purdue University Extension Bulletin "*Anthracnose of Cucumber, Muskmelon and Watermelon*", BP-180-W at this link **http://www.extension.purdue.edu/extmedia/BP/BP-180-W.pdf** or call Dan Egel for a copy.

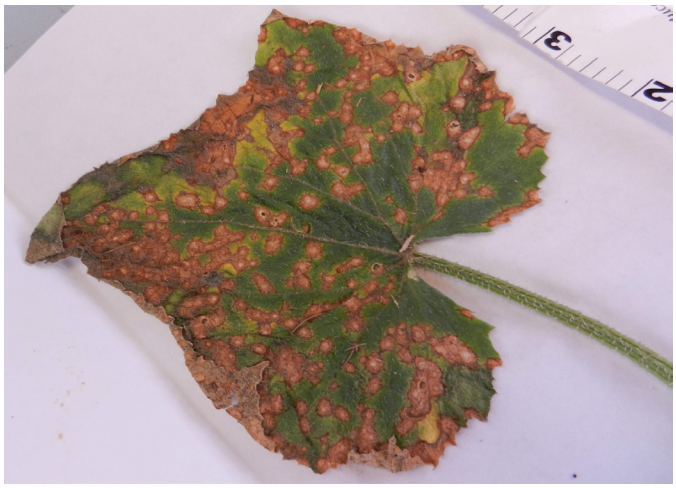

Figure 1: Anthracnose of cucumber causes relatively large lesions with a light brown necrosis. *(Photo by Tom Creswell)*

OZONE INJURY - *(Liz Maynard)* - When ground level ozone is high enough to trigger an Air Quality Action Day alert from the Indiana Dept. of Environmental Management (IDEM) it is a reminder that crops may be injured by ozone. A number of areas around the state have experienced alerts in recent days. If crops show the symptoms described below and ozone levels have been high, consider the likelihood of ozone injury.

Ozone is a gas with three oxygen atoms per molecule. It is formed in the air when nitrogen oxides and volatile organic compounds react in the presence of sunlight. Ground-level ozone is a primary component of smog. Ozone harms people by aggravating existing breathing problems like asthma and injuring lung tissue. It harms sensitive plants by damaging leaf tissue, reducing the capacity to photosynthesize.

IDEM issues daily air quality forecasts for ground level ozone from May to September, available at **http://www.smogwatch.in.gov/**. An Air Quality Action Day is called when ozone (or other pollutants) are expected to be high enough to cause problems for sensitive groups of people. Sensitive plants are injured at or below these levels. Injury is more likely under hot and humid conditions. The list in Table 1 shows Indiana counties, which have historically experienced frequent high levels of ozone.

Symptoms of ozone injury on plants include interveinal chlorosis and necrosis, bleaching, stippling (small, darkly pigmented areas approximately 2-4 mm diameter), flecking (tiny, light-tan irregular spots less than 1 mm diameter), bronzing, and reddening. Older and middle-aged leaves are usually affected first. Often just the upper leaf surface is affected. On some plants both upper and lower leaf surfaces are affected. The chlorosis and necrosis are similar to what is seen with normal leaf aging and death. Crops and varieties differ in sensitivity and specific symptoms. The stage of crop growth and environmental conditions also influence the degree of injury observed.

On watermelons, injury appears first on older leaves. Areas between veins yellow (interveinal chlorosis) and eventually turn dark and then white (see Figure 2). On squash and pumpkins, older leaves show interveinal chlorosis and bleaching (see Figure 3, next page). On snap beans, ozone causes bronzing on upper leaf surfaces and leaves may yellow and die (see Figure 4, next page). On potatoes, younger leaves show dark stippling on upper and lower leaf surfaces (see Figure 5, next page).

If crops show these symptoms, other possible causes are ruled out, and ozone has been high in the area, it is reasonable to suspect ozone injury. To the extent possible, avoid additional stresses on the plants. Don't apply unwarranted pesticides or nutrients. Note which varieties show fewer symptoms and in the future, select varieties that are less susceptible.

Individuals and businesses can help to reduce ground-level ozone by conserving electricity, refueling vehicles after dusk, limiting engine idling, and using volatile chemicals in ways that keep evaporation to a minimum. For additional information about ozone and steps individuals and businesses can take to reduce ozone levels, visit **http://www.airnow.gov**, click on 'What You Can Do' or 'Ozone'.

Table 1: The following counties have historically experienced high levels of ozone. *Information collected from Indiana Department of Environmental Management*.

- Allen
- Boone
- Clark
- Delaware
- Elkhart
- Floyd
- Greene
- Hamilton
- Hancock
- Hendricks
- Jackson
- Johnson
- Lake
- Laporte
- Madison
- Marion
- Morgan
- Porter
- Shelby
- St. Joseph
- Vanderburg
- Vigo
- Warrick

Figure 2: Ozone injury on watermelon leaf. *(Photo by David B. Langston, University of Georgia,* **http://bugwood.org***).*

Figure 3: Ozone injury on pumpkin leaf. *(Photo by M. McGrath USDA ARS).*

Figure 4: Ozone injury on snap beans. *(Photo by Soctt Bauer, USDA ARS).*

Figure 5: Ozone injury on potato leaf. *(Photo by Mary Ann Hansen, Virginia Polytechnic Institute and State University,* **http://bugwood.org***).*

Plant diseases and how they spread during the growing season - *(Nathan Kleczewski)* - We are in the middle of the growing season and some of you may be starting to see some diseases moving into your fields or greenhouses. I cannot think of any grower except those that work at the Southwest Purdue Agricultural Center that actually want to see disease on their crops. As a result, it is common nature for most of us to "jump the gun" when it comes to disease, and respond, sometimes incorrectly, to diseases reported at other farms. It is important to understand that just because a disease is present at one farm does not always mean that it will move onto your farm. This is because the spread of plant disease varies with the type of plant pathogen.

Plant pathogens, for the most part, can be classified into five major groups: 1) fungi; 2) fungal like organisms; 3) bacteria; 4) viruses; and 5) nematodes. Today I will describe the main mechanisms of spread for these organisms, and provide pertinent examples for Indiana vegetable crops. Generalities for the various groups are found in Table 2, page 5.

1. **Fungi:** Fungi are one of the most common plant pathogenic groups, and as you may know from reading your copy of the *Midwest Vegetable Production Guide* (ID-56), numerous types of fungi can attack many different plant crops. Many fungi reproduce by producing spores, which are reproductive bodies consisting of one or a few cells. These spores can be relatively large, thick walled, and melanized, allowing for prolonged survival in harsh environments (e.g. cleistothecia produced by powdery mildews; sclerotia produced by Sclerotinia). Conversely, spores may be small and survive for a relatively short periods of time (e.g. Alternaria, Botrytis, Didymella, Septoria, and powdery mildews). Fungi can produce different spores during their lifetime. For example, powdery mildews produce large, thick-walled cleistothecia that allow the fungus to survive the winter. These spores open and produce infective spores the following spring. During the growing season, powdery mildews produce another, smaller spore on the leaves of infected plants that can be windblown several miles. These spores can infect susceptible plants in distant fields. In general, fungal pathogens that do not produce smaller spores tend to move more slowly, as disease spread tends to be mainly through the soil, water, seed, or through movement of plant debris. Fusarium wilt of melon and diseases caused by Rhizoctonia are examples of slow-moving pathogens. Conversely, diseases caused by fungi producing the smaller spores on aerial plant parts may spread quickly to other fields under the appropriate environmental conditions, although the spores of different pathogens may travel different distances. A list of major fungal pathogens of Indiana vegetables and their mechanisms of spread are found in Table 3, page 5.

2. **Fungal like organisms** (FLO's)**:** Pathogens that are characterized as FLO's are considered by many growers to belong to the fungal pathogen group. However, these organisms are more closely related to

brown algae than the true fungi. These organisms differ morphologically and physiologically from fungi. This is a major reason why specific fungicides often must be applied to control these organisms (e.g. Pythium, Phytophthora). FLO's such as downy mildew, Pythium, and Phytophthora produce both thick-walled resting spores and smaller spores that can be wind dispersed. As a result, diseases caused by these pathogens may be dispersed within the growing season by wind. For example, downy mildew cannot survive the cold winter temperatures of Indiana. Every year the smaller spores blow onto Indiana crops from warmer areas where the appropriate hosts can overwinter or in greenhouses where hosts may be produced in the winter months (see Figure 6). Phytophthora and Pythium that cause disease on Indiana vegetables may produce spores that are dispersed aerially, but the distance these spores travel is relatively short. As a result, movement of these pathogens tends to be limited to adjacent fields or plots, and long distance movement is not an issue.

3. **Bacteria:** Bacteria are another commonly encountered plant pathogen. Unlike most fungi, bacteria tend to be dispersed locally, from plant to plant via rain or through soil. Some specialized bacterial pathogens, for example *Erwinia tracheaphilia* (the causal agent of bacterial wilt of cucurbits) are dispersed long distances by insects. In the case of *E. tracheaphilia*, the cucumber beetle picks up the bacterium from an infected plant (e.g. squash) and ingests it as it consumes the plant tissue. Next, the beetle flies to another plant or field, and feeds on a healthy squash. The bacteria enter the wounds created by the beetle as it chews on the new plants. In addition, the beetle deposits frass containing the bacteria into the plant wounds, resulting in infection. Without the cucumber beetle, *E. tracheaphilia* would not be able to be transmitted long distances. Many bacteria spread long distances through seed (e.g. angular leaf spot, bacterial fruit blotch, and bacterial leaf spot). Consequently, long-distance movement of these pathogens within a growing season is often not a problem (see Table 3, next page). Practices that can cause plant wounds, such as turning vines, pruning, or weeding, may contribute to spread between nearby plots or fields. Short distance disease spread can be reduced by following good sanitation practices.

4. **Viruses:** The movement of viruses of Indiana vegetables is predominately dependant on insect vectors such as aphids (Cucumber mosaic virus), leafhoppers (curly top), thrips (Tomato spotted wilt), nematodes (Tomato ringspot), and whiteflies (Lettuce infectious yellows). Viruses enter the insects' mouthparts or gut when the insect feeds on an infected plant. Transmission of the virus to a new plant occurs after a virus-containing insect feeds on a healthy plant. The rate of spread depends on the insect and its interaction with the virus, along with many other factors such as the environment and the host. For example, some viruses can only be carried in the insect mouthparts for a short period of time (Cucumber mosaic virus), whereas others may actually reproduce inside of the insect, allowing the insect to spread the disease the remainder of that particular growth stage (Tomato spotted wilt). Other factors, such as the capacity for movement by the insect and the feeding behavior of the insect, may influence the rate of within-season disease spread. Maintaining good insect control in your greenhouses and fields often results in excellent protection from these vegetable viruses.

Some virus diseases, such as Tomato mosaic virus, are not insect-vectored and survive in plant debris or soil. These viruses can be spread easily from plant to plant in the greenhouse on unsanitized cutting tools or pots, and may move into the field through in infected seedlings or seeds. Dispersal from field to field within and between growing seasons is often not an issue so long as you properly sanitize boots, tools, and machinery and follow good sanitation practices.

5. **Nematodes:** Nematodes of Indiana vegetables are soil borne, and movement of these pathogens occurs entirely through the soil. Long distance movement of the pathogens during the growing season can occur if infected plants or soil are moved to uninfected areas. Spread can be curtailed by following sound sanitation practices.

If you hear that a grower is experiencing issues with a disease it may not be necessary to break out the sprayer. Instead, give your local extension educator or the Southwest Purdue Agricultural Center a call, and see if you should be concerned about the disease moving into your field. A phone call may save you the time and money associated with making unnecessary chemical applications to your plants.

Figure 6: The spores of the fungus that causes downy mildew of pumpkin may spread over many miles. However, most diseases do not spread as widely as downy mildew. Downy mildew of cucurbits has not been reported in Indiana this year. *(Photo by Dan Egel)*

Table 2: The main groups of plant pathogens and some general comments on how they move and spread within the growing season.

Pathogen Group	Examples	Main form of within-season movement	How the pathogens move within-season	Distance Spread
Fungi	-early blight -gummy stem blight -Fusarium wilt -powdery mildew -Rhizoctonia	Spores and hyphae	Depends on the fungus. Examples include aerially, soil, and plant debris	-Fungi producing small, aerial spores tend to spread via wind and may travel great distances. -Those not producing small aerial spores tend to spread short distances.
Fungal-like organisms	-Downy Mildew -Pythium -Phytophthora blight	Spores and hyphae	Aerially and in soil/water	-Pythium and Phytophthora typically move short distances. -Downy mildews may spread great distances.
Bacteria	-Angular leaf spot -Bacterial fruit blotch -Bacterial spot	Living bacterial cells	Plant-to-plant in raindrops or soil. May be insect-vectored	-Typically short distance -If insect vectored distance can be large.
Viruses	-Cucumber mosaic virus -Tomato spotted wilt -Tomato ringspot	Virus units	Often insect vectored. May move short distances in soil	-If insect vectored, distance may be great but highly variable. -If not vectored, movement is often limited.
Nematodes	-Root knot nematode -Stubby root nematodes	Adult nematodes	In soil	Short distances

Table 3: A list of some major diseases of Indiana vegetable crops and their means of within-season dispersal.

Pathogen Group	Disease name	Main mode of within-season spread	The amount of spread likely in one dispersal event
Fungus	Alternaria leaf blight	Aerial spores	Plant to plant
Fungus	Anthracnose	Aerial spores	Plant to plant
Bacteria	Bacterial fruit blotch	Rain splash, equipment	Leaf to leaf
Bacteria	Bacterial leaf and fruit spot	Rain splash, equipment	Leaf to leaf
Bacteria	Bacterial canker	Rain splash, equipment	Leaf to leaf
Bacteria	Bacterial wilt	Cucumber beetle	Miles
Fungus	Botrytis grey mold	Aerial spores	Plant to plant
Virus	Cucumber mosaic virus	Aphids	Miles
Virus	Curly top of Tomato	Leafhopper	Miles
FLO	Downy mildew	Aerial spores	Miles
Fungus	Early blight	Aerial spores	Plant to plant
Fungus	Fusarium crown rot	Hyphae, soil, equipment	Unlikely within one season
Fungus	Fusarium wilt	Hyphae, soil, equipment	Unlikely within one season
Fungus	Gummy stem blight	Aerial spores	Plant to plant
FLO	Late blight	Aerial spores, spores in soil/water	Plant to plant
FLO	Phytophthora blight	Aerial spores, spores in soil/water	Plant to plant
FLO	Phytophthora root rot	Aerial spores, spores in soil/water	Unlikely within one season
Fungus	Plectosporium blight	Aerial spores	Plant to plant
Fungus	Powdery mildew	Aerial spores	Miles
Fungus	Pythium damping off	Aerial spores, spores in soil/water	Unlikely within one season
Virus	Tomato mosaic virus	Soil, equipment	Plant to plant
Nematode	Root knot nematode	Soil	Unlikely within one season

Sweet Corn Variety Trial Open House at Pinney-Purdue Ag Center - Sweet corn growers and others are invited to observe sweet corn variety plots at the Pinney-Purdue Ag Center, 11402 South County Line Road, Wanatah during informal open houses on the following dates (all times are **Central** time):
Monday, July 25, 5:00 to 6:30 p.m.
Friday, July 29, 5:00 to 6:30 p.m.
Monday, Aug. 1, 5:00 to 6:30 p.m.
Wednesday, Aug. 3, 5:00 to 6:30 p.m.
Friday, Aug. 5, 5:00 to 6:30 p.m.
Monday, Aug. 8, 5:00 to 6:30 p.m.
Twenty-one varieties of sugar-enhanced and synergistic sweet corn and 20 varieties of supersweet (sh2) sweet corn will be available for viewing. Harvest of se and synergistic types will begin July 23 and end about Aug. 1; harvest of supersweet types will begin about Aug. 1 and end about Aug. 8. For additional information contact Liz Maynard at (219) 531-4200, **emaynard@purdue.edu**. Watch **http://twitter.com/#!/nwch** for updates on harvest dates for particular varieties.

Sweet Corn Varieties in Trial Plots at Pinney-Purdue, 2011	
Se and Synergistic	**Supersweet/Augmented Supersweet**
CSYBF7-263	Summer Sweet 2012 MR
Pay Dirt	ACX SSW 4002 MR
Ka-Ching	Summer Sweet 7002 R
Cameo	Summer Sweet 7112 R
Paydirt	ACX SSW 7403 RY
Fastlane	Summer Sweet 7602 MR
Rendezvous	Summer Sweet 7712 MR
Pow-wow	ACX 7902
Jackie	Summer Sweet 7932 MR
Ambrosia	HMX 8343BS
Espresso	HMX 9352BS
Profit	HMX 0361WS
Allure	Sweet Surprise
08TG110	09B2840
1080	Obsession
1102	EX08767143
Vitality	EX08745857-R
Temptation	BSS 8040
Synergy	GSB 2873
SEB6SH1102	Stellar
SEB6RH1080	
Primus	
BC 0822	

Horticultural Crops Research Tour - On Wednesday August 10th from 7 to 9 p.m. there will be a tour of the research activities of the Purdue University Meig's Research Farm. Topics include high-tunnel vegetable and flower production, cover crop management in organic vegetable systems, mating disrupters for insect management, opportunities and challenges for fruit crops, heirloom tomato variety trial, and organic vegetable breeding. For more information contact Lori Hoagland at (765) 494-1426 or **lhoaglan@purdue.edu**.

Indiana Clean Sweep - The Office of the Indiana State Chemist (OISC) will again sponsor the Indiana Clean Sweep Project this year to collect and dispose of suspended, cancelled, banned, unusable, opened, unopened or just unwanted pesticides. There is no charge for this service up to 250 pounds per participant. Anyone can participate in this project. The project will run 9 a.m. to 3 p.m. EST at the following locations:

·August 9, 2011: Marshall County Fairgrounds, Argos, IN

·August 11, 2011: Huntington County Fairgrounds, Huntington, IN

·August 16, 2011: Hendricks County Fairgrounds, Danville, IN

·August 18, 2011: Jefferson County Fairgrounds, Madison, IN

In order to participate in this project it is necessary to obtain a Pesticide Clean Sweep Planning Form and mail, fax or email the form to Kevin Neal at (765) 494-4331 or **nealk@purdue.edu** no later than Tuesday August 2, 2011. For more details contact Kevin Neal using the information above or call Dan Egel. This is a great opportunity for you to legally dispose of unwanted products!

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