VEGETABLE CROPS HOTLINE

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

Issue: 641
April 26, 2018

In This Issue

Organic Control Methods for Striped Cucumber Beetles

(Rick Foster, fosterre@purdue.edu, (765) 494-9572) & (Laura Ingwell, lingwell@purdue.edu)

One of the most problematic insect pests that organic vegetable growers have to deal with is the striped cucumber beetle. The insect feeds on all the cucurbit crops, but can be particularly devastating to muskmelons and cucumbers because those two crops are susceptible to bacterial wilt of cucurbits, which is caused by a bacterium carried by the beetles. The only way to avoid this devastating disease is to prevent the beetles from feeding on the plants. There are no effective organic insecticides for managing striped cucumber so we have to look for alternative methods.

1. **Row Covers:** Row covers can be used to physically prevent beetles from feeding on the plants. To be effective, these need to be placed over the plants immediately after transplanting or before direct seeded crops emerge. The edges of the row covers should be sealed with soil to prevent the beetles from crawling under the fabric and attacking the plants. One downside of row covers is that they must be removed or at least opened up on the ends when female flowers appear so that pollination can occur. This action, of course, also exposes plants to feeding from cucumber beetles. Row covers are also fairly expensive and practical only on fairly small plantings. Row covers will also protect plants from seedcorn maggots, so growers may want to use this technique on very early plantings.
2. **Trap Crops:** Various types of squash are more attractive to striped cucumber beetles than cucumbers or muskmelons. Since the squash are not susceptible to bacterial wilt, they can tolerate a lot more feeding damage than the vulnerable crops. Planting squash a little earlier than your nearby cucumbers and muskmelons will often result in more beetles on the squash and fewer beetles on the susceptible crops. It is important to recognize that once the trap crop declines, the beetles will be searching for a new host.
3. **Beetle Traps:** Recently, Dr. Jaime Pinero from Lincoln University in Missouri, developed traps that can be used to trap out most of the striped cucumber beetles from a small farm. The instructions for how to construct and use these traps can be found at https://ipm.missouri.edu/IPCM/2016/6/A-novel-mass-trapping-system-to-control-cucumber-beetles-in-cucurbit-crops/. These traps are homemade with the basic unit being 1 gallon milk jugs (Figure 1), so it might be a good idea to start working on these now. The attractant and the stun pill must be purchased. An alternative to the stun pill may simply be drowning the captured insects by filling the base of the jugs with water and some soap to break the surface tension. We will be testing these traps at several sites this summer and will report the levels of control we receive in future *Vegetable Crops Hotline* articles.

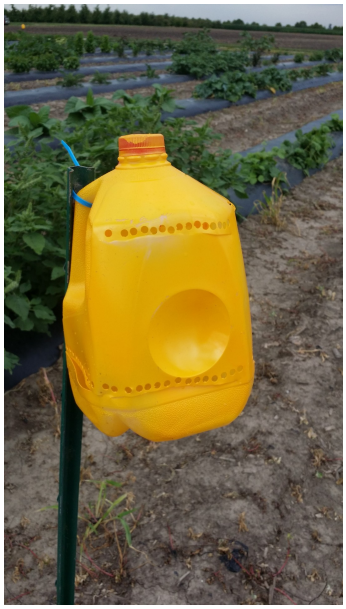

Figure 1. Yellow jugs trap cucumber beetles.

4. **Exclusion Screens**: For those growing in high tunnels, it can be effective to install insect exclusion screens to

prevent cucumber beetles from damaging the crops (Figure 2). If growing parthenocarpic varieties you do not need to worry about pollinators. However, if a pollinator-dependent crop is produced bumblebees can be purchased from commercial supplies and perform well in high tunnels as well as greenhouses. Care should be taken when selecting a mesh screen, our research has shown that a pore size of approximately 0.8 x 1.0 mm is sufficient to exclude the beetles while minimizing the reductions in ventilation (Figure 3). Secondary pest outbreaks, such as aphids, have occurred more often when screening was applied to high tunnels. Careful scouting plans should be in place to monitor for aphids and mites in these situations.

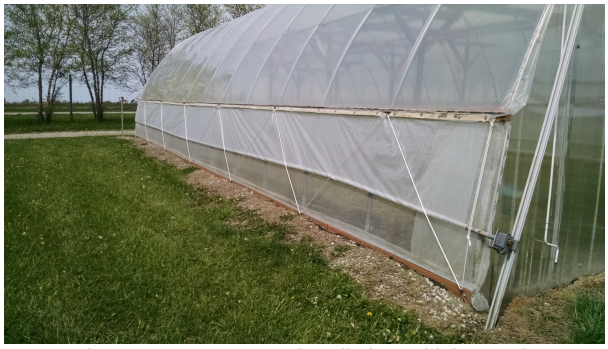

Figure 2. Insect screens installed on a high tunnel.

Figure 3. A cucumber beetle on the 0.7 x 1.0 mm screen (photo by: John Obermeyer)

While there are also a variety of natural enemies in these systems that attack cucumber beetles, the economic threshold of 1 beetle per plant for the crops susceptible to bacterial wilt limits the feasibility of this control method. These natural enemies include spiders, ground beetles, nematodes that attack the larvae and pupae in the soil, and parasitic flies. Combinations of the techniques described above, such as combining trap cropping with the beetle jug traps, may be the most effective organic strategies for controlling this devastating pest and pathogen.

Seed and Root Maggots

(Rick Foster, fosterre@purdue.edu, (765) 494-9572)

Three species of seed and root maggots attack vegetables in Indiana. The seedcorn maggot feeds on seeds and seedlings of sweet corn, cucurbits, lima and snap beans, peas, and other crops. Cabbage maggots can cause serious damage to transplants of cabbage, broccoli, cauliflower, and Brussels sprouts and make the fleshy roots of radishes, turnips, and rutabagas unmarketable. Onion maggots are pests of seedling onions, developing bulbs and onions intended for storage.

Seedcorn maggot flies emerge in April and May and lay eggs preferentially in areas with decaying organic matter. Fields that are heavily manured or planted to a cover crop are more likely to have seedcorn maggot injury. Maggots burrow into the seed and feed within, often destroying the germ. The seeds fail to germinate and plants do not emerge from the soil, leaving gaps in the stand. When infested seeds germinate, the seedlings are weak and may die. Maggots also will feed within the stems of transplants (Figure 1).

Figure 1. Seedcorn maggot in a melon stem

Any condition that delays germination may increase damage from this pest. Damage can be reduced by planting into a well-prepared seedbed, sufficiently late to get rapid germination. The slower the rate of growth, the greater the likelihood of seedcorn maggot injury. For any type of early season transplant, soil temperatures should reach at least 70° F or more for 4-5 days in a row to avoid maggot injury. Anything that raises soil temperature (black or clear plastic mulch) will increase soil warming and decrease the possibility of seedcorn maggot injury. Once damage is observed, the only management strategy available is the decision to replant or not. If you decide to replant, be sure to use treated seed. When resetting transplants be sure to wait 5 days from the first evidence of wilted plants before you reset. Unfortunately, we don't have any insecticides that can be applied at planting time that will provide good control of seedcorn maggots. Admire Pro® and Platinum®, which both provide several weeks of excellent systemic control of striped cucumber beetles when applied at planting, are not labeled for seedcorn maggots and the control is marginal at best. Capture LFR® is labeled for control of wireworms, grubs, and other soil insects on cucurbits but not for seedcorn maggots. I have one year of data with Capture® that showed fairly promising results, but more data are needed.

Cabbage maggot injury is also favored by cool, wet conditions. The flies, slightly smaller than a housefly, emerge in late April or early May and lay white eggs at the base of newly set plants.

Larvae from this first generation tunnel in the roots of small plants, causing the plants to appear sickly, off color or stunted, and may cause them to die. Early cabbage and turnips are particularly vulnerable to damage. Control of first generation maggots can be achieved using soil insecticides such as Capture LFR®, Lorsban® or diazinon at planting or transplanting. For short season crops such as radishes and turnips, long-residual insecticides cannot be used. Cabbage maggots usually do not affect later planted crucifers.

Onion maggot flies emerge throughout May and lay eggs at the base of onion plants. The maggots attack the underground portions of the onion plants and cause plants to wilt and die. Seeded onions are more susceptible than transplanted onions. Do not overseed to compensate for losses to onion maggots. The flies do not space their eggs evenly, so you may end up with smaller bulbs because the plant spacing is too close. The second-generation flies emerge during July and the third generation emerges during late August and early September. Each generation will damage onions.

Removing cull onions after harvest and planting as far as possible from fields planted to onion the previous year can reduce damage. Soil drenches of Lorsban® (dry bulb only) or diazinon at planting will effectively control first generation maggots and provide some control of the second generation. As the onions begin to mature, they become physically resistant to attack from onion maggots, unless they have been injured in some way. Be careful during field operations not to damage the growing plants in any way. A nick in an onion bulb allows the maggots to enter and begin feeding. Also, the flies are attracted to damaged onions to lay eggs. Reducing the amount of physical damage to the onions at harvest as much as possible will also reduce the amount of injury from the third generation. Do not apply foliar sprays to kill flies before they lay eggs.

Prune Determinate Tomatoes

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

I have recently received a number of calls from growers about how to prune determinate tomatoes in a stake and weave system. Although this is relatively easy compared to how to prune indeterminate tomatoes with a trellis system, there are a few things I would like to call to your attention.

What to prune

The common practice is to prune the suckers at the bottom of tomato plants. The benefit of this practice is to improve airflow which may help to control foliar diseases. Shoots of determinate tomatoes stop growing once they set a terminal bud. Most of us understand that if suckers are pruned too much, plants may have reduced yield. However, there is confusion about exactly what to prune.

Normally, the bottom 6-7 suckers should be pruned until the first flower cluster. But it is important to note that the sucker just below the first flower cluster develops a very strong shoot (Figure 1), which will produce a large number of tomatoes. We find it works best to leave this sucker and prune everything below this point (Figure 2).

Figure 1. Leave the sucker right below the first flower cluster (indicated by the arrow on the right), prune the sucker indicated by the arrow on the left, and all the suckers below it.

Figure 2. A tomato plant that has been pruned. Sometimes it works better to prune suckers first and prune bottom leaves when they begin to decline.

When to prune

The ideal time to prune suckers is about when the first flower cluster start to bloom, around the stage showing in Figure 3. If suckers are pruned before the formation of the first flower cluster, it is difficult to know exactly what to prune. While if plants are pruned too late until the suckers grow big, removing suckers will create large lesions on the stem that facilitate the infection of pathogens. Another important consideration is that it is best for the lesions to dry out as soon as possible so there is less chance of disease infection. With this in mind, the morning of a sunny day normally is the best time to prune the plants.

Figure 3. Prune the suckers when the first flower cluster starts to bloom.

Tomato Lesion Primer

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

I recently encountered some lesions of Tomato Spotted Wilt Virus (TSWV) that appeared relatively large and had a ring-like structure. I was able to confirm the presence of the virus, but at first glance, the lesions could be mistaken for a very common tomato disease: early blight. This article will describe how the foliar lesions of these two diseases might be distinguished. First, a bit about the symptoms of these diseases.

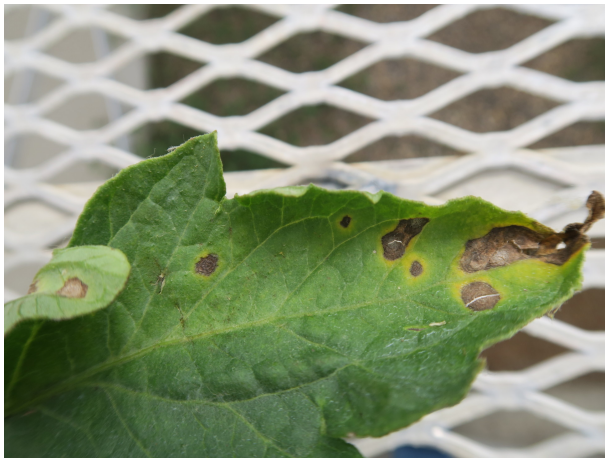

Figure 1. The early blight lesions on the top of this tomato leaf have a concentric ring structure. While the lesions on the leaf bottom lack a ring pattern, the lesions are prominent.

Early blight is perhaps the most common foliar disease of tomato in Indiana. One might first notice that the older leaves turn necrotic. If left uncontrolled, the diseased lesions appear to 'move' up the plant. A closer look at early blight lesions may reveal the bull's-eye lesions of this disease (Figure 1). These lesions may also be described as having concentric rings similar to a target. (Early blight is not the only disease to have concentric rings.) I usually don't take photos of the underside of lesions, but Figure 1 also has a lesion that can be seen on the bottom of the leaf. Although it lacks, concentric rings, the difference between this photo and later photos of TSWV is clear. Most foliar disease lesions are obvious on the top and bottom of leaves, such as with early blight. But read on for an exception.

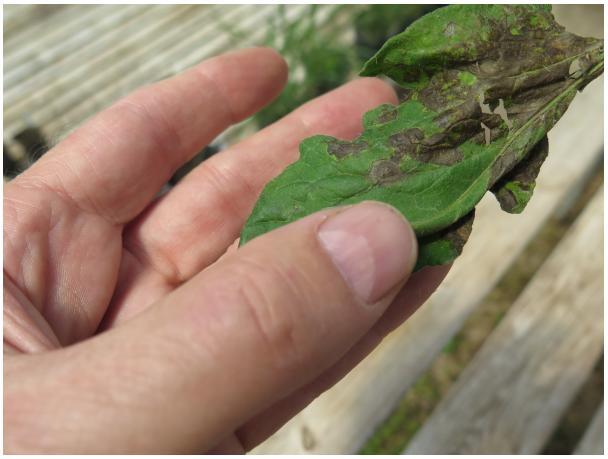

Figure 2. Lesions of Tomato Spotted Wilt Virus on the top of tomato leaves often have a ring pattern.

The lesions of TSWV on the top of the tomato leaf in Figure 2 have a similar ring pattern to the early blight lesions in Figure 1. Now, let's flip the leaf over and look at the bottom of the leaf (Figure 3). The lesions of TSWV on the bottom of the same leaf range from almost invisible to a light gray, somewhat circular pattern. Thus, one way in which early blight lesions can be differentiated from TSWV lesions is by looking at the underside of the lesions. Early blight lesions will normally show up clearly on both sides of a leaf. Lesions of TSWV do not necessarily show up clearly on both sides of a leaf. In general, disease lesions show on both sides of leaves. TSWV is an exception.

Figure 3. The lesions of Tomato Spotted Wilt Virus on the bottom of the same tomato leaf in Figure 2. The lesions shown here consist mostly of collapsed tissue and are not distinctive.

There are other important differences in biology that helps to distinguish early blight and TSWV. Early blight is a fungal disease that requires leaf moisture for infection. For this reason, early blight is not usually observed in greenhouses or high tunnels. TSWV is a virus disease that is transmitted by thrips. Often, TSWV is observed in greenhouses or high tunnels that are used to grow vegetables and flowers side-by-side.

It is very difficult to distinguish foliar diseases by the symptoms.

When in doubt, it is always best to send a sample to a diagnostic laboratory such as our own Plant and Pest Diagnostic Laboratory.

Updates to the Midwest Vegetable Production Guide

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

The *Midwest Vegetable Production Guide for Commercial Growers 2018* (ID-56) was printed in December 2017. At the same time, the on-line version was posted at mwveguide.org. As updates need to be made to the ID-56, I will make those updates to the on-line version. I will announce these updates in the *Hotline* as I post them. Consider the updates below and mark those updates in the hard copy of your ID-56 that will affect you. Briefly, Quadris Top® has been changed to silent on greenhouse use, Luna® products have been added to crops in the fruiting vegetable chapter, and RUP® has been added to Pounce 25WP® under sweet corn. My thanks to the several individuals who have suggested updates.

Fungicide table, page 79-Change Quadris Top® from no to silent under the column for greenhouse use.

Eggplant, page 134-under anthracnose, add Luna Sensation® at 7.6 fl. oz. per acre. 3-day PHI.

Eggplant, page 134, under white mold, add Luna Sensation® at 7.6 fl. oz. per acre. 3-day PHI.

Pepper, page 137, under anthracnose, add Luna Sensation® at 7.6 fl. oz. per acre. 3-day PHI.

Pepper, page 138, under powdery mildew, add Luna Sensation® at 7.6 fl. oz. per acre. 3-day PHI.

Pepper, page 139, under white mold, add Luna Sensation® at 7.6 fl. oz. per acre. 3-day PHI.

Tomato, page 141, under anthracnose, add Luna Sensation® at 7.6 fl. oz. per acre. 3-day PHI.

Tomato, page 142, under Botrytis gray mold, add Luna Tranquility® at 11.2 fl. oz. per acre. 1-day PHI and Luna Sensation® at 7.6 fl. oz. per acre. 3-day PHI.

Tomato, page 143, under early blight and Septoria leaf spot, add Luna Tranquility® at 11.2 fl. oz. per acre. 1-day PHI and Luna Sensation® at 5-7.6 fl. oz. per acre. 3-day PHI.

Tomato, page 145, under powdery mildew, add Luna Tranquility® at 11.2 fl. oz. per acre. 1-day PHI.

Tomato, page 145, under white mold, add Luna Sensation® at 7.6 fl. oz. per acre. 3-day PHI.

Sweet corn, page 227, under fall army worm, add RUP to Pounce 25WP®.

To the table on page 146, add these products:

Fungicide rating code: VG=very good. G=good. F=fair. P=poor. S=suppression only. ID=labeled, but insufficient data to allow rating.

	Product Luna Sensation (12/3)	**Common Name** fluopyram (7), trifloxystrobin (11)	**Product** Luna Tranquility (12/1)	**Common Name** fluopyram (7), pyrimethanil (9)
Anthracnose(T)	S			
Anthracnose(P)	S			
Bacterial canker				
Bacterial spot/speck				
Botrytis gray mold	G		ID	
Buckeye rot				
Early blight	ID		VG	
Septoria leaf spot	ID		VG	
Late blight (tomato)				
Phytothphora blight (P)				
Leaf mold				
White mold	G			

Finding Pesticide Labels for State-specific Registrations

(Liz Maynard, emaynard@purdue.edu, (219) 548-3674)

Many pesticides for use on vegetables have varying rules for use in different states. This article will review the different classes of labels for pesticides and where to find labels online.

The shorthand names for classes of labels come from the section of the Federal Insecticide, Fungicide, and Rodenticide Act that governs each class. National labels are called Section 3 labels. These labels are approved by EPA for uses throughout the country. The Master Label on file with the EPA includes all registered uses. The label on a marketed product often contains only a subset of those uses. Even with federal approval of a Section 3 label, in order to be sold and used in Indiana, the product must also be registered with the Office of the Indiana State Chemist. To find products that are registered in Indiana, visit the NPIRS public web site. http://npirspublic.ceris.purdue.edu/state/state_menu.aspx?state=IN. Search by product name, EPA registration number, company name, or active ingredient. Several products may come up. Select the appropriate one. For most products, there will be a link to the label that is approved in Indiana.

When there are conditions specific to one state, a Special Local Needs, or 24C label may be approved that describes additional uses registered and permitted in that state. Sometimes 24C labels are available at sites such as http://cdms.net/, or from the manufacturer's website. Products with 24C labels in Indiana will be listed on the state NPIRS public site, but the listing title may not include all crops, and the label may not be available there. For instance, a search for 'Dual Magnum®' turns up a listing for 'Dual

Magnum® – Transplanted Bell Peppers', with IN Registration Number SLN IN-1300003, but there is no link to a label. In the case of this product, the manufacturer requires that users assume risk of using the product. This is called an indemnified label. For Syngenta products like Dual Magnum®, the indemnified labels are available at http://farmassist.com/. To find one, look under 'Crop Protection' and then 'Labels – Indemnified labels.' At this point the user will need to register with Syngenta, agree to the user agreement, and create a username and password. Then, login with those credentials, and follow instructions on screen to obtain a pdf copy of the label.

When there is an emergency need for a pesticide, a Section 18 label may be approved. On the NPIRS site these products can be identified because the IN Registration Number will begin with S18.

The label is important because it explains how to legally use the pesticide. It is also useful because it provides instruction on how to use it most effectively and with least injury to the crop. A three-ring binder with current labels and MSDS sheets for your pesticides makes it easy to review use and safety instructions. Alternatively, or in addition to a binder, storing pdfs on a computer, tablet, or phone means they are readily accessed even when an internet connection is not available.

References:

Section 3, Federal Supplemental Label, Sections 18 & 24c – What's the Difference? Washington State Department of Agriculture

https://agr.wa.gov/pestfert/chemfert/agassistwsda/2010/9-23-10.pdf

Pesticide Emergency Exemptions. Environmental Protection Agency.

https://www.epa.gov/pesticide-registration/pesticide-emergency-exemptions

Guidance on FIFRA 24(c) Registrations. Environmental Protection Agency.

https://www.epa.gov/pesticide-registration/guidance-fifra-24c-registrations

Upcoming events

Southwest Purdue Ag Center High Tunnel Tour

Date: June 13, 2018 7:00-9:00 pm Eastern Time

Location: Southwest Purdue Agricultural Center, 4369 North Purdue Road, Vincennes, IN, 47591

The SWPAC high tunnel tour will be held on the evening of June 13, 2018. Attendees will have the opportunity to see a wide range of research projects being conducted in high tunnels at SWPAC.

Topics that will be discussed include: Grafting cucumbers for season extension; Seedless cucumber and summer squash variety evaluations in a high tunnel; Different pruning and trellising systems for growing cucumber, tomato and pepper in a high tunnel; Grafting tomatoes for improved yield; Cucumber beetle management; Annual plasticultural strawberry production with an innovative low tunnel system.

Registration will begin at 6:30 pm. The tour is free, to register please call (812) 886-0198, for more information please contact Wenjing Guan (guan40@purdue.edu). This event is sponsored by North-Central Sustainable Agriculture Research and Education.

2018 Indiana Hort Society Summer Field Day

Date: June 26

Location: Garwood Orchard, LaPorte, IN

Please contact Lori Jolly-Brown at ljollybr@ purdue.edu for more information about the field day.

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High Tunnel Tour
Southwest Purdue Ag Center

4369 N. Purdue Road, Vincennes, IN 47591

Wednesday, June 13, 2018

7:00 PM – 9:00 PM (EST)

Registration and self-guided tour start at 6:30 PM (EST)

Highlights of 2018 High Tunnel Tour: Seedless Cucumber Production

- Evaluate 16 seedless cucumber varieties.
- Learn cucumber grafting technique and its potential to extend early season cucumber production.
- Observe different trellises and pruning systems for growing cucumbers in high tunnels.
- Discuss management options for striped cucumber beetles.

If you already or plan to grow cucumbers in high tunnels, this will be a field day that you will not want to miss!!!

- In addition to cucumbers, this event will include topics on high tunnel **tomato**, **pepper** and **summer squash** production. You will learn about variety selection, pruning and trellising systems, as well as how to maximize benefits of using grafting technique on tomatoes.
- Last but not least, you will see a demonstration of growing **strawberries** with plasticulture and an innovative low tunnel system.

The tour is free, to register please call: Southwest Purdue Ag Program (812) 886-0198. We may be able to arrange transportation upon request. For more information, please contact Wenjing Guan at guan40@purdue.edu.

This high tunnel tour is sponsored by Purdue University and North-Central Sustainable Agriculture Research and Education (NC-SARE). Project number LNC17-390.

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