Vegetable Crops Hotline

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

Issue 620 - September 1, 2016

In This Issue

Aphids on Cucurbits

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

Over the past several weeks, there have been a number of reports of high populations of aphids on cucurbits, as well as report of disappointing levels of control with various insecticides. Without getting into the specifics of individual complaints, here are some suggestions for improved control of aphids.

1. Remember that our primary method of control of aphids is natural enemies. There are a wide variety of predators and parasites than usually keep aphids at reasonable levels. Usually, an outbreak of aphids is an indication that a grower has done something to kill off the natural enemies, which allows aphid populations to reproduce unchecked. And, aphids have a very high reproductive capacity, so without those natural enemies they can build up in number very quickly. Obviously, there are other pests that cucurbit growers need to control, so some disruption of the natural enemies is to be expected. However, growers should only be spraying for pests like cucumber beetles when they exceed the threshold of 1 beetle per plant for cantaloupes and cucumbers and 5 beetles per plant for the other cucurbits. Throwing an insecticide in the tank because you are spraying fungicides rather than as a response to high beetle populations, is not a good idea. Not only are you likely to kill the natural enemies and create an aphid or mite outbreak, but we showed many years ago that cantaloupes sprayed weekly with a pyrethroid insecticide had lower yields than cantaloupes that were sprayed only when the threshold was exceeded.
2. We don't have exact thresholds for aphids like we do for cucumber beetles and other insects. Insecticides should only be applied when numbers are increasing. If you find a few aphids, mark the location in the field and come back 5 days later and see if the number has increased. If not, it may be that the natural enemies are doing their job. If they are increasing you should consider spraying. Remember that a few aphids will not affect the yield or quality of you crop. Make sure that there are enough to worry about. And, never spray for aphids preventatively. Confirm their presence and increase in numbers before treating.
3. Planting time applications of neonicotinoid insecticides such as Admire Pro® or Platinum® will provide a number of weeks of control of aphids, more than the 3 weeks of cucumber beetle control that we get. Although we worry about the impact of those products on pollinators, they are effective aphid control materials. Beginning 3 weeks after planting when cucumber beetle number reach the threshold, an application of one of the pyrethroids is appropriate for cucumber beetle control. If both aphids and cucumber beetles are issues, then the choice of a product that works for both, such as Assail®, would be appropriate. One of the reasons we often recommend Assail® over Actara® is because of lower potential for harm to pollinators. If only aphids are the issue, growers should consider one of the more specialized aphid insecticides, such as Beleaf®, Exirel®, Fulfill®, or Sivanto®.

Although many aphids can be observed on this cantaloupe leaf, lady beetles are preying on aphids and several aphids have been parasitized by a small wasp.

Pumpkin Fruit Set

(Liz Maynard, emaynard@purdue.edu, (219) 548-3674) & (Dan Egel, egel@purdue.edu, (812) 886-0198)

There has been some concern about poor fruit set in pumpkin fields that otherwise have healthy vigorous vines. This summer we have experienced above normal temperatures for much of the pumpkin fruit set season and I suspect that has played a role. This article will consider temperature as well as other factors that influence pumpkin fruit set.

In order for fruit set to take place, male and female flowers must be open on the same day, pollinating insects must be active, the plant must not be too stressed and it must have an adequate level of carbohydrates. Growers can influence some of these conditions.

High temperatures promote death of female pumpkin flowers while still in the bud stage. Varieties differ in the their sensitivity to high temperatures. To determine whether flowers have died early in development requires close inspection of the pumpkin vine. An aborted bud often dries up and remains on the vine, but is only a few centimeters long and not easy to see under heavy vine growth (Figures 1 and 2).

Figure 1. Pumpkin female flower bud that aborted before opening

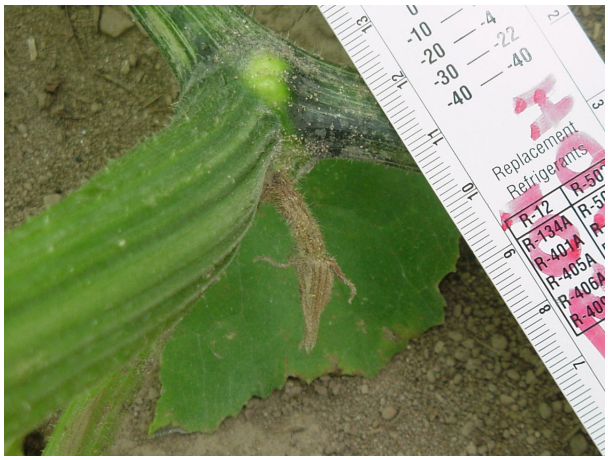

Figure 2. Pumpkin female flower bud that aborted before opening

Nitrogen levels in the soil can influence pumpkin fruit set through effects on flower development. Excess nitrogen promotes vigorous vine growth but delays flowering. If the delay coincides with high temperatures, fruit-producing flowers may not develop at all until too late to produce much yield.

Pumpkin flowers are usually pollinated by honey bees, squash bees, and bumble bees. Pollination occurs in the morning when flowers are open and bees are active. Multiple bee visits to a flower are needed in order to transfer enough pollen for fruit set. Each flower is open for just one day, and if a female flower doesn't get pollinated on that day it will gradually yellow and fall off. To know whether bees are active in a field, take a look in the morning before it gets hot and flowers close. If bee activity is spotty and there aren't any honey bee or bumble bee hives present, it may be worthwhile to bring hives in. Research in Illinois showed an advantage to having honey bee hives present for pumpkins. Work in New York indicated that the benefit of bringing honey bee or bumble bee hives in depends on the landscape within about 1.25 miles of the pumpkin field. Landscapes with more diverse plants and those with a higher percentage of "grassland" (fallow, weedy ditches, and semi-natural areas) did not benefit as much from supplemental bees. For a summary of the New York work, see *The Decision-Making Guide for Bee Supplementation of Pumpkin Fields* at https://ecommons.cornell.edu/handle/1813/43268. Whether relying on natural bee populations or hives brought in for pollination, careful use of insecticides is important to avoid harming the pollinators. Purdue publications about bees are available at https://extension.entm.purdue.edu/publications/pubs/bee.html. Table 10 in the *Midwest Vegetable Production Guide for Commercial Growers* has information about pesticides and bee safety.

After pollination (when pollen is transferred to the female flower) pollen grains must germinate and grow to fertilize each ovule that will develop into a seed. Without this step, the seeds won't start to grow and if seeds don't grow the pumpkin fruit will die and fall off. If only seeds at one end or on one side of the fruit start to grow, the pumpkin will be lopsided. High temperatures can prevent proper pollen tube growth, and so even if flowers open and get pollinated, fruit may not set. Sometimes inspection will reveal flowers that have bloomed but not set fruit, and the aborted fruit is covered with a fuzzy mold (Figures 3 and 4). This is Choanephora fruit rot which can often be opportunistic; attacking fruit that was dying anyway. This is unlikely to be the primary cause of poor fruit set, and fungicides are not effective against this type of fruit abortion.

Growing a pumpkin fruit and the seeds inside requires a lot of energy from the plant, along with water and mineral nutrients. Energy comes from carbohydrates produced by the plant through photosynthesis. If the plant doesn't have enough energy, female flower buds and fruit may stop developing, yellow, and die. High temperatures, particularly at night, make the plant burn energy more quickly. Cloudy days mean less sunshine to supply energy for photosynthesis. This year, high temperatures in July coincided with rainy weather in portions of the state, so light was low when energy demand was high. Foliar diseases and too much shade from weeds also reduce photosynthesis and fewer carbohydrates are produced. There is evidence that shading the one leaf near a female pumpkin flower can reduce fruit set for that flower. Injury

from herbicides can also stress plants and lead to death of flower buds. Generally, stressed plants, no matter what the cause, have low energy reserves.

Figure 3. The fungus on this senescent female pumpkin flower (Choanephora sp.) is growing on a flower which did not develop properly.

Figure 4. The fungus Choanephora sp. is growing on an female pumpkin flower that failed to develop.

Basic good management practices will help the pumpkin plant meet the energy demand of growing fruit. In dry conditions irrigation is likely to be important. Weed control is important, not only to avoid shading, but also to reduce competition for water. If uneven emergence and plant size make normal cultivation difficult or less effective at eliminating weeds, hoeing or hand-weeding, or spot treatments with herbicides may be warranted.

We have observed no diseases that cause the symptoms of poor fruit set described in this article. If you think you may have a disease, contact the Purdue Plant and Pest Diagnostic Laboratory or the authors of this article.

These are the basics of what we know about pumpkin fruit set. For cases where fruit set was an issue this year, hopefully one or more of these factors will be a reasonable explanation, and one can begin to consider what might be done differently next year, if anything.

Corn Earworms

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

Corn earworm flights are quite variable around the state, but are generally heavy. Counts in pheromone traps are higher in the northern part of the state, with the LaPorte County trap reporting 1422 moths over a 7 day period last week. That's about 20 X the threshold level. As I wrote in the last newsletter, growers need to be spraying frequently when silks are green during this period of time. If you are growing one of the Bt varieties, especially in the northern part of the state, I would still recommend at least a moderate spray program to ensure that you get the results you are looking for.

Preharvest Intervals

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

Late summer is a time when vegetable growers spend much of their time harvesting produce. Many growers, however, also find it is necessary to apply pesticides. All pesticides label state a preharvest interval (PHI) on the label. This is the amount of time, in days, between the time the fruit is sprayed with a pesticides and the time it can be harvested. That is, after a pesticide is applied to a vegetable crop, a specific amount of days must pass before the fruit is harvested. This article will breifly describe how PHIs are determined, give some examples of PHIs and list a couple of questions about PHIs. I have used examples of vegetable crops and fungicides, however, the same concepts apply to apply to all pesticides and all produce.

The reason the US EPA determines PHIs is to ensure that produce that is consumed does not have unsafe pesticide residues. The first step in determining a PHI is to determine a safe pesticide residue for human consumption. This is known as a tolerance. That is, how much of the pesticide, or breakdown product of the pesticide, is a safe level in the fruit or vegetable. Then the EPA conducts studies of pesticides applied to produce at different times before harvest to determine how much time is necessary before the tolerance level is achieved. For example, some vegetables may be harvested the day of pesticide application. Other vegetables may not be picked for several days.

Some examples follow.

- Fontelis® has a 0 Day PHI on tomato and a 1 Day PHI on cucurbits.
- Dithane M45® has a 5 Day PHI on tomato and a 3 day PHI for potato.
- Quadris® has a 0 day PHI for carrots, while Quadris Top® has a 7-Day PHI for the same crop.
- Bravo Weather Stik® has a 7-Day PHI on garlic and a 14-Day PHI on green bunching onions.

I have had a couple of questions about preharvest intervals that I thought would be useful to share.

Question #1: I have harvested tomatoes with a product that requires a 5-Day PHI. Can I harvest the tomatoes immediately and then keep the tomatoes in storage for 5 days before being

sold? This type of situation might occur if the produce were to be kept cool for a number of days before a buyer was found.

Answer #1: The first thing to keep in mind, is that the label is the law. Since the label states do not harvest the tomato for 5 days, the law must be followed. Now, let me explain some details.

When the PHI is determined, it is based on the produce remaining on the plant until harvest because that is the way the assay was conducted. Once the produce is harvested, respiration changes in the fruit and the breakdown of the pesticide may slow. In this case, if the tomato is harvested immediately after application, the respiration of the tomato changes and may modify the breakdown of the pesticide.

Question #2: Can I harvest my watermelon sooner than the 7-Day PHI if I wash it well before sale?

Again, the label is the law. Since the label does not state anything about a quicker harvest if washed, such an exception is not allowed. Here are some details.

A product that is systemic cannot be washed off. Even if a contact product is applied, the PHI assays were not conducted with washing as a variable. It is not known how much the pesticide residue may be reduced if washed. In addition, my produce wash may be different than your wash. Therefore, washing makes no difference to the PHI.

As vegetable growers select fungicides for harvest time, the PHI should be carefully considered in these choices. PHI values are listed in the *Midwest Vegetable Production Guide for Commercial Growers*. However, always check the label to make sure you are using the right value.

High Tunnel Evaluation of Vertically-Grown Cantaloupe and Galia Melon Varieties

(Petrus Langenhoven, plangenh@purdue.edu, (765) 496-7955)

In issue 619 of the *Vegetable Crops Hotline* newsletter I reported that during April 2016 research focusing on the development of a unique market segment for Indiana melon growers was initiated. The research aims to demonstrate that through the use of high tunnels or greenhouses growers will be able to market melons earlier and increase yield while keeping quality undeniably high. Initial research focused on variety evaluation in a soil and soilless production system in high tunnels and a greenhouse, where the plants were trellised vertically. In the long term, we aim to establish the best production practices for high tunnel and greenhouse growers in Indiana and we will do a complete life cycle analysis to determine the profitability of the proposed production systems. Well it sounds all easy to do, but in reality I have experienced several production related issues during the growing season. Let me present to you some details about the research.

During late April and early May 2016 eight melon varieties were planted at the HLA Plant Growth Facility (HGRH) on campus (greenhouse), at Meig's Farm, which is part of the Throckmorton Purdue Agriculture Center (24' x 48' high tunnel), and at the Purdue Student Farm (30' x 96' high tunnel). Eight varieties, of which six have never been grown before in the U.S., were evaluated. Varieties included Sephia and Migdal (Galia types), Magnificenza and Tirreno (Italian netted cantaloupe), Kenza (Charentais), Karameza (long shelf life, fully netted cantaloupe), and Rawan and Rowena (Ananas type). Enza Zaden provided germplasm for the variety trial. On campus and at Meig's Farm plants were grown with hydroponic techniques in soilless medium culture using coconut coir as substrate. At the Student Farm plants were grown in the soil. All planting rows were orientated east-west.

Figure 1. Figure 1: Four transplants planted per one coconut coir slab (39" long, 7.75" wide and 4" high)

Trial Quick Facts: Purdue Student Farm

Sow date: 4/5/2016

Plant date: 4/26/2016

Between-row spacing: 3 feet

In-row spacing: 18 inches

Plant density: 4.5 sq. ft. per plant or 9,680 plants per acre

First flowers open: 05/20/2016 (22 days after transplanting, 45 days from seeding)

Trial Quick Facts: HLA Greenhouse Facility

Sow date: 4/5/2016

Plant date: 4/28/2016

Between-row spacing: 4 feet

In-row spacing: 9.84 inches

Plant density: 3.28 sq. ft. per plant or 13,280 plants per acre

First flowers open: 05/10/2016 (12 days after transplanting, 35 days from seeding)

Trial Quick Facts: Meig's Farm

Sow date: 4/5/2016

Plant date: 5/10/2016

Between-row spacing: 4.5 feet

In-row spacing: 9.84 inches

Plant density: 3.69 sq. ft. per plant or 11,805 plants per acre

First flowers open: 05/16/2016 (6 days after transplanting, 41

days from seeding)

Figure 2. From left to right. Purdue Student Farm planting (5/30/2016); HLA Greenhouse (05/26/2016); Meig's Farm (06/10/2016)

Plant nutrition: Melons planted at the Student Farm were only fertilized pre-plant with Greenkeeper's Secret 32-0-5 Jumpstart (100 lb per acre N). Melons grown in the HLA greenhouse were irrigated throughout the growing season with a nutrient solution that consisted of 148 ppm N, 23 ppm P, 104 ppm K, 141 ppm Ca, 49 ppm Mg, and 86 ppm S, and the EC was 2 $mS.cm^{-1}$ and pH 5.8. Melons produced at the Meig's Farm were irrigated for the first five weeks with a nutrient solution that consisted of 143 ppm N, 48 ppm P, 217 ppm K, 194 ppm Ca, 59 ppm Mg, and 131 ppm S. The nutrient solution EC was between 2.0 – 2.2 $mS.cm^{-1}$ and the pH 6 – 6.5. From week six onwards the nutrient solution was adjusted to an EC of 2.4 $mS.cm^{-1}$. During that period the nutrient solution consisted of 160 ppm N, 60 ppm P, 271 ppm K, 199 ppm Ca, 67 ppm Mg, and 162 ppm S.

Plant husbandry: All plants were trellised vertically 8 feet high, and all lateral shoots were removed by hand from the bottom up on the first 18 inches of main stem growth. All tendrils were removed. Laterals that developed from other nodes were left until it could be confirmed that fruit set has occurred. Laterals were then removed in order to have fruit develop on laterals growing from every second node. Fruit development is limited to one fruit per lateral. The lateral shoot was terminated two leaves from the developing fruit. Bumblebees (from Koppert Biological Systems) were used for pollination.

Challenges:

- The Meig's Farm planting was done 12 and 14 days after the HGRH and Student farm plantings, respectively. This was due to a delay in equipment installation. The seedlings were therefore already 12-18" long. The Student farm trial was planted first, and due to too low soil temperature initial growth was slow and some of the transplanted seedlings developed Damping-Off (Pythium sp./spp.). Plants produced in the soilless substrate was not affected.
- At Meig's Farm we had several irrigation issues. Chemilizer® water powered fertilizer injection pumps were used to inject the concentrated citric acid (Growth Products), and 5-11-26 (Peters Professional) and 15.5-0-0 (Jack's Professional) fertilizer. On three occasions the pumps malfunctioned which meant that the EC and pH levels required could not be maintained at all times. A water supply issue was also experienced during the early stages of anthesis and fruit set. This resulted in the abortion of female and male flowers, and fruit that has already been set.
- The role-up windows of the high tunnels at the Student Farm and at Meig's Farm were covered with an insect screen (Econet 100400, Svensson), but somehow the spotted and striped cucumber beetles were still able to enter the growing area. The Student Farm melon planting was first affected by the beetles (late May). At Meig's Farm beetles were first observed during the second week of June. The beetles did transmit bacterial wilt which affected the crop at a later stage. The beetles did show a preference for Sephia (worst affected), Migdal and Kenza. The least affected varieties were Rowena, Magnificenza, Karameza and Rawan. Sephia was also the worst effected by bacterial wilt, followed by Rawan, Migdal, Tirreno and Kenza. Rowena, Magnificenza and Karameza was the least affected. The HGRH trial was not affected.
- During anthesis, especially in the HLA greenhouse, many flowers were pollinated by the bumblebees but several developing fruit aborted a few days after fruit set. This did occur at the Student Farm and Meig's Farm as well and might be due to the high humidity and temperature in the high tunnels and greenhouse. This might have been exacerbated by the high planting densities used.
- The varieties selected for these trials had intermediate resistance to powdery mildew (Px: 1,2,5). However all varieties, excluding Sephia and Rowena, were severely affected by powdery mildew. Sephia and Rowena showed no symptoms of infection. The application of fungicides were purposefully withheld to evaluate the intermediate resistance of the varieties to powdery mildew.

In the next issue I will present a short summary of some of the yield and quality data.

Figure 3. Plant infected with bacterial wilt, transmitted by spotted and stripped cucumber beetles

Figure 6. Rowena (healthy plants on the right) was more tolerant to powdery mildew

New Pollinator Publication

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

We just completed a new publication that will assist fruit and vegetable growers in protecting pollinators while still managing their insect pests. The title is "*Protecting Pollinators in Fruit and Vegetable Production*." It can be found at https://extension.entm.purdue.edu/publications/POL-2/POL-2.html. There are two companion publications in this series, "*Protecting Pollinators in Home Lawns and Landscapes*" and "*Protecting Pollinators: Tips for Commercial Agricultural Pesticide Applicators*." Additional publications in this series will target agronomic crop producers, folks who want to plant a pollinator garden, and how youth can help to protect pollinators.

Upcoming Events

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

Beginning Farmer Tour

Date: September 29, 2016

Location: River Ridge Farm, Roann, IN.

This four-season farm produces vegetables and small fruits. The tour will include information about operating an on-farm store, farm-to-school, and four-season growing.The tour will be 9 A.M. – 3:30 P.M. (EST). Lunch will be served.The tours are free, but registration is required. Registration at https://mdc.itap.purdue.edu/wk_rules.asp?itemID=22368

Aquaponics Conference

Date: October 28-29, 2016

Location: Kokomo Event & Conference Center, 1500 N. Reed Road in Kokomo

Aquaponics is a system that combines fish rearing and vegetable production. Topics include food safety of vegetables, pest control in aquaponics operations, indoor environmental conditions, vegetables for aquaponics, greenhouse structures and fish in aquaponics operations.

Early-bird registration fee through Sept. 18 is $90 for Indiana Aquaculture Association Inc. (IAAI) members and $100 for non-members. After that date, registration is $100 for IAAI members and $125 for non-members. An optional tour of Green River Greenhouse can be added for an additional $20 per person. Registration is available at www.indianaaquaculture.com.

7th National Small Farm Conference

Date: September 20-22, 2016

Location: Virginia Beach Convention Center, Virginia Beach, VA

More information about the conference can be found at http://www.vsu.edu/nationalsmallfarmconference/

Vegetable Crops Hotline © Purdue University - vegcropshotline.org
Editor: Wenjing Guan - 4369 N. Purdue Road Vincennes, IN 47591 | (812) 886-0198 | guan40@purdue.edu