



UNIVERSITY OF ILLINOIS EXTENSION

College of Agricultural, Consumer, and Environmental Sciences

Illinois Fruit and Vegetable News

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A newsletter for commercial growers of fruit and vegetable crops

"We are what we repeatedly do. Excellence, then, is not an act, but a habit." Aristotle

Address any questions or comments regarding this newsletter to the individual authors listed after each article or to its editor, Rick Weinzierl, 217-244-2126, weinzierl@illinois.edu. The *Illinois Fruit and Vegetable News* is available on the web at: <http://ipm.illinois.edu/ifvn/>. To receive email notification of new postings of this newsletter, call or write Rick Weinzierl at the number or email address above.

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Upcoming Programs

Check the Illinois SARE calendar for a full list of programs and links for registration.

<http://illinoissare.org/> and <http://illinoissare.org/calendar.php>

Also see the University of Illinois Extension Local Food Systems and Small Farms Team's web site at:

<http://web.extension.illinois.edu/smallfarm/> and their calendar of events at

<http://web.extension.illinois.edu/units/calendar.cfm?UnitID=629>.

- **University of Illinois Pumpkin Field Day, September 2, 2015.** 10:00 a.m. – 2:00 p.m. at the University of Illinois Vegetable Crops Research Farm. Topics include varieties, production systems, herbicides and weed control, insect management, pumpkin disease management, spray equipment, post-harvest issues, and marketing. Registration and lunch are free, but pre-registration is requested to allow preparation of lunches. See <https://web.extension.illinois.edu/units/event.cfm?UnitID=629&EventID=68197>, email Mohammad Babadoost (babadoos@illinois.edu), or call Devin Quarles at 217-333-5299.
- **Illinois Specialty Crops, Agritourism, and Organics Conference, January 6-8, 2016.** At the Crowne Plaza Hotel and Conference Center, Springfield, IL. More to come in future issues of this newsletter ... for now, save the date.

Regional Reports

From southern Illinois ... We have continued with very humid conditions across southern Illinois, with temperatures in the upper 80s to 90s throughout the last couple of weeks. The forecast is for a break in the humidity and heat, with a system going through mid-week that will drop temperatures down to the mid-80s for a few days and also give us some sunny, rain-free days. In the last two weeks, in Murphysboro we have gotten about 1.4" of rain, but rains have been very scattered and rainfall totals have varied greatly.

You can find a wide variety of products in local markets, including tomatoes, peppers, melons, potatoes, peaches, squash, and cucumber among many other things. Most everyone would agree that this has been a challenging year for many of our annual vegetable crops, with struggles getting succession plantings made, especially for sweet corn. As of last week, some growers were still trying to get in one last planting of sweet corn due to missing some earlier timings.

At home, my pumpkins are just about ready to close in most of the rows with vines. In scouting I have not seen any powdery mildew or downy mildew as of yet but am starting protective sprays, knowing that this is the time when these diseases can show up quickly. I have seen a few cucumber beetles, but no squash bugs yet. Cucumber beetles have not been enough to warrant adding an insecticide to the spray tank, however, I expect I probably will manage them in the next few weeks. I am approaching the end of harvest on my 'Black Satin' blackberries.

In our high tunnel at the Jackson County Extension Office we have peppers, cucumbers, tomatoes, and leeks. We have had many pest management challenges, including a major spider mite infestation on the cucumbers about a month ago and aphids and whiteflies on the tomatoes. Most have been managed fairly easily, but the whiteflies on the tomatoes (and most other plant material in the tunnel) have been a major challenge. Due to a relatively short life cycle and their ability to hide in dense foliage, I have yet to completely conquer them with insecticide applications. I attribute much of this to not catching them early enough before their populations exploded.



Whiteflies on the underside of the tomato leaf and "honeydew" on tomato fruit with dense infestations of whiteflies.

Here are a few suggestions I have for managing whiteflies from my experiences. As always refer to the [2015 Midwest Vegetable Production Guide](#) for labeled products and PHIs. Make applications when whiteflies are first observed. A high tunnel (or greenhouse) is an ideal environment for population explosions and once that occurs, management becomes very difficult. Get thorough spray coverage with insecticide applications. With determinate tomatoes or any crop with dense foliage, it is very difficult to get coverage. Consider using a mist blower or spray gun that allows good spray penetration throughout the canopy especially the underside of leaves where whiteflies like to hide.

Nathan Johannng (618-687-1727; njohann@illinois.edu)

From western Illinois ... We had gone two weeks without rainfall until Sunday August 9, when the area received varying amounts of moisture. Anywhere from ½ inch to over 4 inches fell over a short time on Sunday morning. Crops were beginning to need some moisture and a few growers had started up some limited irrigation via trickle tape. Although we have received ample rains the past three months, most of that moisture ran off as the soil was saturated. Roots have not recovered from the poor growing conditions, and moisture was needed. We'll need to continue to receive these timely rains for the next several months to keep growing conditions active.

Weed and disease pressure has been extremely high this summer. Many are finding it very difficult to keep weeds under control, and both the conventional folks and the organic folks have had issues with too much rain. The conventional producers had herbicides leached out of the topsoil very quickly. The organic producers, who rely upon tillage to a great extent just didn't have the capacity to do much tillage with the constant rains. As a result, the weed seed bank will certainly expand this year. It might be worthwhile to simply use a mower to help with out-of-control areas. It's certainly a time to consider what other options might exist for the future. The use of plastic mulch (of which

biodegradable is an option) certainly makes weed control much easier, at least in the row. Use of organic mulch is another option, but remember that organic mulch does not accelerate early spring growth in the way plastic does. Another useful tool is landscape fabric between rows of vegetables on plastic. These fabrics are designed to be used for multiple years. Others may want to consider spacing raised beds with plastic on widths that match your mower so that you can mow to help control weeds between the raised beds.

Many early cucurbit crops have succumbed to various plant ailments (old age, squash bug, powdery mildew, etc.). This is not uncommon, so succession plantings are required for season-long harvests. It's the time to consider what fall crops you may want. Transplants of cole crops need to be started very soon, if not already. Direct seeding of other crops seems to be the most efficient method. Many growers benefit from a fall/winter harvest season. There are many crops that can do well in the cool/cold conditions of fall/winter. Use of low tunnels, high tunnels, row covers, and clear plastic (usually in combination) can provide quite a bit of protection.

High-tunnel tomatoes have begun to slack off in production. Most are determinates, and unless growers took precautions to prevent diseases (leaf mold, etc.) and insects (aphids/mites/etc.), production is declining. Some growers use a July planting to capitalize on fall demand as the spring crop declines.

Powdery mildew of cucurbits is common and producers should be on the lookout. Dr. Mohammad Babadoost provides a listing of products and a suggested spray schedule each year. We have placed that on our web page at <http://web.extension.illinois.edu/abhps/localfoods.html>. Several growers have commented on the poor production of their vine crops (cantaloupe and watermelon) including splits, and washy flavor. I expect that these conditions will improve as a result of the reduced amount of rain we've encountered of late.

Insect pressure has been a mixed bag. Japanese beetles are still active, but corn earworm moth flight is still non-existent. I don't believe I've trapped more than a couple of moths over the past month, which is very unusual, but we notice quite a few worms in the corn we're just now picking. Squash bugs are active, as are cucumber beetles in untreated cucurbits.

Mike Roegge (217-223-8380; roeggem@illinois.edu)

Fruit Production and Pest Management

Notes on Fruit Insects and Mites

Codling moth in apples, stink bugs in apples and late peaches, and spotted wing Drosophila in small fruits and peaches are all concerns now.

- Second generation codling moth flight is peaking at Urbana now ... southern Illinois was a couple of weeks ahead of us, and in northern Illinois this flight peak is probably yet to come. Where moth flight (and egg-laying) is ongoing, egg-hatch and larval entry into fruit follows about 240 degree-days later (base 50 F). This means that cover sprays need to continue on later varieties even as early varieties reach harvest in a few weeks. Be sure to check the [2015 Midwest Tree Fruit Spray Guide](#) for preharvest intervals (PHIs) for insecticides used for codling moth control. The PHI for apples is 5 days for Altacor and 7 days for Assail and Delegate.
- Stink bug feeding during the last few days before harvest in peaches does not cause catfacing as it does earlier when peaches are rapidly enlarging, but it does cause corking and discoloration of the flesh beneath the feeding puncture. In apples, stink bug feeding at this time of year also causes corking of the flesh. Pyrethroids are among the most effective insecticides for stink bug control in peaches and apples ... be sure to check PHIs in the [2015 Midwest Tree Fruit Spray Guide](#). Belay is also effective and has a 7-day PHI in apples; its 21-day PHI in peaches precludes further use this season in most locations and varieties in Illinois.
- Spotted wing Drosophila (SWD) numbers continue to increase in traps and fruit samples from the University of Illinois Fruit Research Farm at Urbana. For everyone with blackberries, red raspberries, and late peaches that you wait to harvest until they are really ripe ... infestations will continue to increase. See the [March 19, 2015, issue of this newsletter](#) for details on sampling and control.

Rick Weinzierl (217-244-2126; weinzier@illinois.edu)

An Overview of Flower and Fruit Drop in Tree Fruit Production

As we reach the time of year when fruit drop before harvest is a big concern in apples, it may be a good time to review the causes (and ways to prevent) flower and fruit drop in tree fruit production. Some fruit trees drop a portion their fruits several times during the growing season. Apples, pears, and lemon trees may drop as much as 80 to 100% of their flower and fruits, depending on several factors, while stone fruits such as cherries and peaches may drop only a small percentage of their flowers and fruits during development. In 1953, L.C. Luckwill reported that apple trees drop their crop at least four times during the growing season. The first occurs during bloom until fruit set, the second at 2 to 4 weeks after fruit set, the third at 4 to 8 weeks after fruit set, and the fourth occurs before harvest.

First drop (Flower drop). Flower drop occurs usually in species and varieties that bloom heavily over an extended period. Flower drop also happens in fruit crops that tend to have heavy bloom that extends over a long period, often in lateral flowers, on any given cluster, especially those that open very late. Late flowers are usually weak and have smaller structures including petals and ovaries. In years of heavy bloom, some of the late-blooming flowers on a cluster may drop as a result of being out-competed for a limited supply of food. Flower drop is usually not very serious unless there is a freeze. Flowers have high amounts of diffusible auxin, a natural hormone, which keeps them from dropping.

Second drop. This drop usually occurs after the completion of pollination and continues for up to four weeks after fruit set, depending on the weather. The primary reason for this drop is a lack of fertilization of the embryo. Almost all fruit trees require cross pollination to set a successful crop. Incompatibility between pollen grains and the stigma of the same cultivar, say Red Delicious or Gala, or between apples and peaches is governed by a pair of alleles called “S – alleles.” One of the S alleles is carried by the stigma (female part of the flower) and the other is carried by the pollen grain (male part of the flower). When the pollen grain from a certain plant lands on the stigma, it deposits a protein on its surface. The compatibility of the protein from the stigma S-allele and the protein from the pollen grain S-allele will determine if the visiting pollen grain will grow and fertilize the ovary of the host flower. The S-alleles determine if a pollen grain from a certain variety will germinate or not. Most apple sports will not pollinate each other. For example, most Delicious strains of apples will not pollinate each other. Also, Melrose will not pollinate Delicious, Macspur will not pollinate McIntosh and so on.



Smaller fruits are likely to drop than larger fruits.

Additionally, in certain varieties of apples, such as Winesap, the S-allele of the pollen grains is not functional and it is known as male- or pollen-sterile. Because of its sterility, Winesap flowers will not be able to pollinate any other apple variety. Another factor that contributes unsuccessful fertilization is the ploidy level. Most plants and animals have two sets of chromosomes and are called diploid. A few oddballs, either through nature or human interference, have three sets of chromosomes; they are called triploids. Triploids also have sterile pollen. Examples in animals are mules, in vegetables seedless watermelon, and in fruit trees Baldwin, Crispin or Mutsu, Granvenstein, Jonagold, Rhode Island Greening, and Stayman. Triploid varieties do not produce viable pollens and so they will not be effective for pollinating other varieties and they must be pollinated by another compatible variety to set a crop. Choosing the correct variety to fertilize triploid varieties is very important. For example, Golden Delicious will not be able to pollinate Jonagold because they are cousins.

How do S-allele, pollen sterility, and triploidy affect fruit drop? For effective fruit set to happen, there has to be a good source of pollen, the pollen has to land on the stigma and germinate, and one of the sperm cells must fertilize the female

egg. Any disruption of these steps will lead to inhibition of seed development. Fruits with no or fewer seeds are likely to drop before they reach full size. So fruit drop at this stage is usually attributed to lack of seed set. The question is what is the relationship between the seeds and fruit drop? Well, the seeds produce the natural hormone auxin. Auxin inhibits the fruit from dropping. Fruits that have a few or no seeds produce less auxin and therefore are likely to drop. Fruits that drop at this stage are not likely to have any seeds, while fruits that have a few seeds will hang on until the next drop.



Three dropped fruits with no viable seeds. The fruit on the bottom has one seed which had kept it attached to the tree a little longer before it eventually dropped.

Third drop. This is the most widely known of the four drops, which is commonly known as “June Drop.” June drop usually happens in mid to late June in years with a heavy fruit set. The primary drive for June drop is competition for a limited supply food reserve. Fruits with the fewest seeds are more likely to drop. If the tree is overloaded with fruits, then the weakest fruit will drop first, creating a natural balance between the food reserve and fruit number. Some fruit trees, such as cherries, are not affected by this drop, possibly because of an abundance of food reserve or the fact that the seeds produce an adequate supply of auxin to stop the fruit from dropping.



The small fruit in the middle is outcompeted for nutrients by the two fruits.

Forth drop. This drop usually happens before harvest when the fruits have reached their full maturity. Some varieties such as Stayman and McIntosh are very vulnerable to pre-harvest fruit drop. The widely accepted theory about why fruits drop at this stage is that the amount of auxin produced by the seeds is not sufficient to keep the fruits from dropping. For this reason, spraying the fruits with NAA (naphthaleneacetic acid), a synthetic auxin, reduces the risk of fruit drop.

The stems of flowers, leaves, and fruits have small bulges towards their ends called the abscission zone. This abscission zone is only a few millimeters thick, and the cell walls of its cells are very rich in pectin (a glue-like material). Naturally, flowers, leaves, and fruits abscise only through the abscission zone and that is why all the stems of fruits and leaves are of the same length when they drop or when they are harvested. Ethylene, another natural plant hormone, stimulates enzymes that dissolve the pectin in this zone causing flowers, fruits, and leaves to drop. The reason NAA, or the natural auxin within the fruit, prevents fruit drop is because at low concentration it inhibits ethylene synthesis. However, at high concentration NAA stimulates ethylene synthesis causing fruits to drop. Flowers and small fruitlets have relatively high auxin, while mature fruits have low auxin, which explain why NAA (a synthetic

auxin) is used to drop flowers and small fruitlets early in the season (too much auxin stimulates ethylene synthesis) and to keep mature fruits hanging on the tree late in the season (low auxin in mature fruits reduces ethylene synthesis). These are typical roles of hormones, which tend to do different things at different concentrations and times.

Some fruits with no seeds, such oranges, limes, and bananas, can reach maturity with little or no drop. These fruits are called parthenocarpic, meaning that they have no seeds. Parthenocarpic fruits are formed either because they are rich in auxin or because pollination provides sufficient stimulus for the pollen grain to grow and fertilize the egg. Interestingly, if you extract auxin from apple seeds and bush it on tomato flowers (stigma) you can produce tomato fruits with no seeds.

While hormones (auxins and ethylene) are considered the driving force for all fruit and leaf drops, many factors contribute to their increase and/or decrease in any giving tissue. Among factors that affect hormonal levels in plant tissue are temperature, wind, chemical and physical damage, imbalance in nutrient levels, too much or too little water, insect and disease injury, certain light wavelength, and many more.

How to minimize fruit drop.

- Keep trees healthy.
- Keep a balance between the fruit load and the amount of leaves on the tree.
- Spray trees with calcium, especially late in the season to reduce fruit drop. Calcium keeps the cells in the abscission zone firm.
- Apply stop drop sprays of NAA or Retain. Both NAA and Retain inhibit ethylene synthesis. Read the label very carefully before you apply these chemicals. For example, NAA needs to be applied about 2 to 5 days before harvest, while Retain is applied about 4 weeks before harvest.

Luckwill, L.C. 1953. Studies of fruit development in relation to plant hormones. I. Hormone production by the developing apple seed in relation to fruit drop. J. Hortic. Sci. 28:14-24.

Mosbah Kushad (217-244-5691; kushad@illinois.edu)

Vegetable Production and Pest Management

Downy Mildew of Cucurbits

Downy mildew of cucurbits was diagnosed by my colleague, Dr. Daniel Egel of Purdue University, in a watermelon field in Lawrence County, Illinois (just across the border from Indiana) on July 23. I was hoping that the disease would not spread to other parts of the state, but on July 30 we observed severe downy mildew in a processing pumpkin field in Mason County. The pathogen will likely spread to other parts of the state.

Downy mildew of cucurbits, caused by *Pseudoperonospora cubensis*, is a very destructive disease. The present strain of the pathogen will likely infect all cucurbit crops (cucumber, gourd, muskmelon, pumpkin, squash, and watermelon). Weather conditions in Illinois generally are very conducive for development of downy mildew.

Downy mildew affects leaves only. Symptoms vary with the host and the environmental conditions, but the first symptom is usually the appearance of indistinct, pale green areas on the upper leaf surface. The pale green areas soon become yellow in color and angular to irregular in shape, bounded by the leaf veins. As the disease progresses, the lesions may remain yellow or become brown and necrotic. During moist weather the corresponding lower leaf surface is covered with a downy, pale gray to purple mildew. Often an upward leaf curling will occur.



Downy mildew on the upper surface of a pumpkin leaf – early stage



Downy mildew on the lower surface of a pumpkin leaf – early stage



Downy mildew in pumpkin field.

If you don't have the disease in your field yet, include chlorothalonil (e.g., Bravo Weather Stik) in your weekly sprays. When you observe downy mildew in your field, you need to spray your cucurbit crops with one of the following fungicide combinations at weekly intervals: Revus 2.09SC or Previcur Flex 6SC or Tanus 50WG or Ranman 3.6SC or Gavel 75DF or Zampro 525F plus chlorothalonil. Results of our field trials in the past years showed that spray applications of Revus + Bravo Weather Stik, alternated with Ranman + Bravo Weather Stik or Tanos + Bravo Weather Stik at weekly intervals, were effective for control of downy mildew on pumpkins.

Mohammad Babadoost (217-333-1523; babadoos@illinois.edu)

Notes on Vegetable Insects and Mites

The two most troublesome problems that growers have been reporting recently are stink bug injury to tomatoes (and other crops) and spider mites on tomatoes, peppers, and cucurbits (in high tunnels and to a lesser extent outdoors). Rick Foster noted similar issues in last week's issue of Purdue University's [Vegetable Crops Hotline](#). Squash bug, worms in cabbage family crops, and aphids on a few vegetable crops are constant concerns as well.

The stink bug infestations in Illinois are made up of multiple species – green stink bug, more than one species of brown stink bug, and to a lesser extent, brown marmorated stink bug. Green stink bugs are especially prevalent at our research farms at Urbana. In general, pyrethroid insecticides such as Baythroid, Brigade, Danitol, Mustang Max, and Warrior are most effective for stink bug control in vegetable crops. Belay and Venom (neonicotinoids) also are labeled on some crops and are effective against stink bugs. These insecticides are toxic to bees, so follow all precautions on their labels.

See the [2015 Midwest Vegetable Production Guide](#) for listings of registered insecticides for stink bug control in specific crops.

Twospotted spider mites are common problems in high tunnels and greenhouses (where the lack of rainfall or overhead irrigation provides conditions very favorable for their development). Acramite, Agri-mek, Oberon, Portal, wettable sulfur, and Zeal are miticides registered for use on one or more of the vegetable crops that frequently suffer mite infestations ... again, check the [2015 Midwest Vegetable Production Guide](#) for listings of registered miticides for specific crops. The [July 16, 2015, issue of this newsletter](#) summarized registrations of miticides for a few common crops and referenced a guide for biological control as well.

Rick Weinzierl (217-244-2126; weinzier@illinois.edu)

Weed Management Update: Start Clean and Stay Clean

With all of the rain this season, weed management has been a major challenge. Cultivating, hoeing, and spraying on a timely basis has been compromised by a great deal of rain especially in late June and July when many crops and weeds were just taking off. One strategy I try to employ on my no-till pumpkins is “start clean and stay clean”. For my production system I use multiple tactics to achieve this:

- 1) Use a cover crop to help mulch and prevent weeds from germinating.
- 2) Minimize soil disruption, which brings up more weed seeds to germinate.
- 3) Use an effective burndown herbicide (glyphosate, paraquat, etc.) keeping in mind especially any herbicide resistant weeds such as marestail or waterhemp.
- 4) Use residual herbicides to manage new weed emergence.
- 5) For weeds that escape consider postemergence sprays (often limited options especially for broadleaf weeds), directed-sprays or hoeing/pulling weeds.
- 6) Do not let weeds go to seed (you will thank yourself in future years).



No-till pumpkins with (left) and without (right) a burndown/residual herbicide.

As an example of this, I took the picture above a few weeks ago in my pumpkins. The strip on the right is a sprayer skip (no herbicide) and on the left a pre-transplant application of Gramoxone, Dual II Magnum, and Sandea with nonionic surfactant had been made about 4 weeks prior to this picture being taken. I have walked through to remove some rogue waterhemp (mainly in the transplanter row where the soil was disturbed) and morningglory plants and applied a grass herbicide, but overall the field has remained fairly clean and manageable. Which side of the picture would you like your field to look like? While soils, weed populations, and weather conditions greatly influence individual results on your farm, using some or all of these tactics can help give you a longer window to manage weeds when you have that unexpected week of wet weather or other something else comes up on the farm. If you have had some struggles with weed management I would encourage you to explore the options available on your crops and try to

make the most of cultural management such as tillage or cover crops, along with available herbicides. As always refer to the Midwest Vegetable Production Guide for details on herbicide options.

Nathan Johannng (618-687-1727; njohann@illinois.edu)

Local Foods Issues

2016 Local Food Systems and Small Farms Webinar Series

University of Illinois Extension's Local Food Systems and Small Farms Team is putting together their 2016 Winter Webinar Series and welcomes your suggestions for topics. You can find past webinars from 2011 to 2015 here: <http://web.extension.illinois.edu/smallfarm/webinar.html>. Is there a topic you would like our subject matter experts to address? If so, send a short note to mhosier@illinois.edu and let us know. **Mark your calendars now for the 2016 series** which will begin on January 14, 2016 from noon – 1:00 p.m. and run 10 to 12 consecutive weeks.

Mary Hosier (217-333-7512; mhosier@illinois.edu)

GAPs Webinar Series, October 7, 14, 21, and 28; 6:00 – 8:00 pm.

University of Illinois Extension will offer a GAPs (Good Agricultural Practices for food safety) webinar series to provide information to growers on how to keep produce safe from production to the market. The past few years we've all seen and heard about examples of where food has been contaminated, and the results often have been catastrophic. Infection with *E. coli* and other organisms has made headlines with cantaloupe, lettuce, beef, and other foods. GAPs training discusses methods to reduce the potential for contamination. Topics in this webinar series will include: What is GAPs?; water quality and testing; soil management; record keeping; traceback, and more. It also will include updates associated with the new rules established by the Food Safety Modernization Act.

The webinar series will be held on Wednesdays, October 7, 14, 21, and 28 from 6:00 p.m. to 8:00 p.m. You may attend the webinars from your home; you will need to have a computer with high-speed internet access and a way to listen to the presentation via your computer (headsets are best, but speakers will work). Each registered participant will be sent webinar instructions, handouts, and a GAPs manual prior to the first webinar and webinar instructions before each subsequent session. The registration fee is \$25 per participant. Pre-registration along with pre-payment is required by October 2, 2015. For more information, contact University of Illinois Extension, Kankakee County, at 815/933-8337. To register, complete the form at <https://web.extension.illinois.edu/registration/?registrationid=12829>.

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