

VEGETABLE CROPS HOTLINE

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



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Seedling Damage by Maggot Pests

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Each and every spring we get reports of poor seed emergence, seedling and transplant damage in early planted crops of all sorts. Most recently in untreated sweet corn, home gardens and transplanted onions. Lucky for us, we got to dive right into this pest and see them in action, but not so lucky for the growers who weren't expecting it! While we don't have a lot to offer in terms of a rescue for these crops affected this year, we hope to help you plan for this in the future and understand what the threat looks like for the remainder of the season.

There are two different species to blame: the Onion Maggot (*Delia antiqua*) and the Seed Corn Maggot (*Delia platura*). There is a third species that attacks brassica crops referred to as the Cabbage Root Fly (*Delia radicum*). All three are nearly identical to the naked eye but can usually be determined based on the host crop association. The remainder of this article focuses on the Onion and Seed Corn Maggots.

What are onion and seed corn maggots and why do I care?

Onion maggot and seed corn maggot can wreak havoc on many vegetable crops, especially if populations have been left unchecked for multiple years. Both maggot species will feed on seedlings and either kill the plant before it can successfully mature or injure the plant, thus giving entry to soil pathogens (think bacterial rots). Damage is typically greater in cool, wet seasons and in soils with high organic matter.

Onion and seed corn maggot are very similar, and even belong to the same fly genus, *Delia*. These cream-colored maggots are small (0.2-0.6

inch) and have between 3-5 generations per year. Both species will overwinter as pupae in the soil and emerge as adult the following year to find suitable host plants.

How do I tell the difference between seed corn and onion maggot?

There are some slight differences in behavior and size that may indicate what species you have on your farm. **Onion maggots have a strong preference for allium species**, and are most problematic in onion, garlic, and leek. **Seed corn maggots are highly polyphagous** and can be found in as many as 40 different plant hosts. Notable cultivated hosts for seed corn maggot include soybeans, corn, beans, peas, cucumber, melon, pepper, potato, and even onion. As a general rule, seed corn maggots typically damage the seed, whereas onion maggots often feed on seedling roots.

If you find a plant infested with maggots, you may be able to distinguish species by size. Onion maggots tend to be fairly large (0.3-0.6 inch), about the size of your average housefly maggot. Seed corn maggots are smaller (0.2-0.3 inch). Determining the maggot species is difficult, and you may need to consult a local expert in order to get a positive identification.

Does it matter what species I have if I (ultimately) want them dead?

No, not really. Both species of maggot can cause significant damage to vegetable crops, and management options are very similar between the species. If you are dealing with maggot damage on your farm, consider some of the options below.

1. **Prevention is key.** If you know you have a history of either seed corn maggot or onion maggot, make sure you take action by preventing an infestation before it starts.
 1. Allow sufficient time for organic matter to break down from the previous crop/cover crop/compost application in order to deter adult oviposition. They are attracted to the decomposing organic matter. Another option is to use a moldboard plow to bury the organic matter deep enough to deter oviposition.
 2. Rotate your crop. Onion maggot, in particular, will continue to be a problem in fields successively planted with alliums year after year. If you want to limit future infestations, consider planting a non-host crop to decrease the likelihood of subsequent maggot problems. If you are rotating your crop to a non-host, make sure you rogue out any volunteers from the previous year.
 3. Use a seed treatment. Insecticide treated seed can be very effective at managing either maggot species. A

number of efficacious products are available including thiamethoxam+ spinosad (FARMORE), cyromazine (TRIGARD), and clothianidin and imidacloprid (SEPRESTO) for many vegetable seeds (Table 1). **If you plan on using seed treatments, exercise good insecticide resistance management practices.** Rotate products between years so you are not exposing multiple generations to the same active ingredient. For example, if you are using FarMore in year 1, rotate to a different seed treatment like Trigard or Sepresto in year 2.

Table 1: seed treatment options to manage <i>Delia</i> maggot infestations in vegetables. Please note that efficacy of these products may differ based on maggot infestation and/or soil type.				
Product	OMRI listed?	Active ingredient	Relative control of maggot	IRAC codes
FarMore FI500	No.	thiamethoxam+ spinosad	Excellent.	4A, 5
Trigard OMC	No.	cyromazine	Excellent.	17
Sepresto 75 WS	No.	clothianidin+ imidacloprid	Good.	4A, 4A
Regard SC	Yes.	spinosad	Excellent/Good.	5

2. **Exclude flies from the crop.** One viable management approach is to keep female flies from finding your crop. Isolate your crop either physically or temporally to reduce maggot infestations.
 1. Keep it covered. Consider using row covering over your susceptible crops to stop adult oviposition (egg-laying). Multiple studies have found that this is a highly effective method at limiting damage from either seed corn or onion maggot larvae.
 2. Avoid maggot damage altogether by planting later in the season to bypass peak infestation. Onion and seed corn maggot have predictable phenological patterns, and you can use degree day models to accurately predict times in the season when maggot risk is high (peak emergence of adults for each generation). Are you interested in having this information available to delay planting to avoid peak adult emergence? If so, email lingwell@purdue.edu.
2. **Monitor, monitor, monitor.** While there is little you can do to manage maggot infestations within the immediate growing season, it's important to identify problem areas so you can plan accordingly for the following year.
 1. The best way to tell if you have *Delia* maggots on your farm is to scout early and often. Fields with poor plant emergence or wilted seedlings (Figure 1) should be inspected for maggot damage (Figures 2-4). Make sure you cull any infested plants.
 2. Use a trap. Multiple trapping methods for adult flies have been developed. A recent study found that white, large diameter, spherical traps paired with *Delia* Lure attractant were the most attractive and caught the greatest number of *antiqua* adults. Yellow sticky cards can also be an effective option when placed around the edges of your field. Admittedly, trapping is the second-best method for scouting seed corn or onion maggot flies. Adults are tricky to properly identify and often don't accurately indicate the degree of infestation, but these are viable detection strategies.



Figure 1. Onion transplants wilting because of maggot infestations. Photo by John Obermeyer.



Figure 2. Maggot in young onion transplant with a penny referenced for size. Photo by John Obermeyer.



Fig. 3 Variation in maggot damage among onion transplants. Photo by John Obermeyer.



Figure 4. Seed corn maggot infesting a melon transplant. Photo by John Obermeyer.

NOTE: Avoid “chasing” adult flies. You may see adult flies (Figure 5) in your field but using foliar insecticides to kill adult flies is not an effective

option for either species. Keep in mind the damage is in the soil, so make sure you target your management decisions to strategies that will protect the below-ground tissues of the plant (i.e. seed treatments or in-furrow applications at planting/transplanting).



Figure 5. Pupal case and adult seed corn maggot fly, *Delia platura*. Photo by John Obermeyer.

4. Are there **natural enemies** that can help suppress the populations?

Yes, both staphylinid and ground beetles are predators that will feed on the soil-dwelling stages of these flies. Entomopathogenic nematodes (EPNs) are another option for control. They have been shown to be effective in laboratory settings, but more research is needed to identify the critical time, soil conditions and rate at which to release these enemies for adequate control in field situations.

Cantaloupe and Watermelon Transplant Diseases

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

Many cantaloupe and watermelon growers are either growing transplants in a greenhouse or are expecting delivery of transplants in the next few weeks. Either way, growers should inspect transplants for disease before planting in the field. Below I will describe several common transplant diseases of cantaloupe and watermelon as well as management options.

Gummy stem blight on transplant seedlings may be recognized by the watersoaked area of the stem near the seed leaves (Figure 1). The watersoaked area may eventually turn brown and woody. A closer look at the woody area may reveal the small, dark fungal structures of the gummy stem blight fungus. Medium brown, irregular lesions may also be observed on true leaves. A watersoaked area near the soil line is more likely to be damping-off (Figure 2). More information about damping-off can be found in previous issue's article [Damping-off of Vegetables](#).



Figure 1. A common symptom of gummy stem blight of watermelon is a watersoaked area where the seed leaves attach to the stem.



Figure 2. Damping-off lesions, such as for this watermelon seedling, typically begin at soil level.

The fungus that causes gummy stem blight (*Stagonosporopsis* spp.) may survive in crop debris, thus overwintering in the field from year to year. This fungus may also be introduced through seed or transplants. It is also possible for the fungus to survive in greenhouse production facilities.

Anthracnose of watermelon is another disease that may be observed on transplants. The lesions caused by anthracnose (*Colletotrichum orbiculare*) are often jagged or sharp in appearance (Figure 3). Stem lesions are less common, but if they occur they may appear watersoaked, light brown and pitted. Such stem lesions will not necessarily appear at the seed leaves. Anthracnose on cantaloupe transplants is less common.



Figure 3. Anthracnose lesions on watermelon often appear jagged.

As described above for gummy stem blight, the fungus that causes anthracnose may survive in crop debris such as in transplant production facilities. This fungus may also be introduced through seed or transplants.

Watermelon transplants with Fusarium wilt often appear wilted or the plant tops may have died back (Figure 4). Symptoms that appear under humid greenhouse conditions may be accompanied by white mycelial growth of the causal fungus, *Fusarium oxysporum* f.sp. *niveum*. Seedlings with Fusarium wilt symptoms may be clustered in transplant trays.



Figure 4. Fusarium wilt on a watermelon transplant with die-back symptoms.

Fusarium wilt may be introduced through seed or transplants. Unfortunately, the fungus that causes Fusarium wilt has long-lived spores that may survive for years in soil, equipment, or transplant trays.

The symptoms of bacterial fruit blotch (BFB) can be difficult to recognize on foliage. Leaf lesions may have a dark necrosis with watersoaked margins (Figure 5). Leaf symptoms of BFB are easily confused with angular leaf spot, a disease that is not often economically important. A laboratory analysis may be required to distinguish these two diseases.



Figure 5. Lesion of bacterial fruit blotch on a watermelon transplant may appear watersoaked.

The bacteria that cause BFB do not often survive in crop debris; the disease is more often transmitted through seed. Although symptoms are more often observed on watermelon, cantaloupe transplants may also be affected.

To guard against these diseases in your field, carefully inspect transplants regularly during production or upon delivery. If unsure about symptoms, send them to the Plant Pest and Diagnostic Laboratory or a similar laboratory for an official diagnosis. Clean and sanitize transplant production facilities and equipment in-between generations. Purchase transplant trays for each generation of transplants or clean and sanitize trays well. Do not use soilless greenhouse mix that has been opened or come into contact with the ground or unclean equipment.

Purchase vegetable seed that has been tested for the diseases described above. Ask your seed company representative if you are uncertain about what tests have been conducted.

If fungicides are applied during transplant production, growers should choose a product that is allowed for greenhouse use. In addition, a contact fungicide with the FRAC group M is recommended so that future use of systemic products will be easier to schedule. Fungicides with the active ingredient mancozeb (e.g., Dithane, Manzate, Roper, Penncozeb) should serve most purposes.

Finally, avoid planting transplants grown from seed lots or greenhouses where any of these diseases has been confirmed. Seedlings that appear healthy may in fact have a disease that has spread from a nearby seedling.

In most years, it will be impossible to avoid at least some of the diseases described above. But, as much as possible, do not plant these diseases with your transplants. In particular, avoid using transplants with Fusarium wilt. Since the Fusarium wilt fungus survives many years in the absence of a host, an introduced fungus may last indefinitely. Plus, watermelon transplants with Fusarium wilt may add a new race or strain of the fungus to your field.

Managing these diseases in the field is a different discussion and will be addressed in many articles throughout the year.

When to Plant Watermelons

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

This is a newly released video about when to plant watermelons.
<https://youtu.be/tHT2mAnNRWk>

Watermelon, cantaloupe, cucumber plants are very sensitive to low temperatures. Even when frost has passed, soil temperatures below 60°F can result in transplant establishment failure. Check soil temperatures before planting. The rule of thumb is to plant watermelon, cantaloupe and cucumber transplants when soil temperatures at the root zone are stable above 60°F. Ideally, watermelon, cantaloupe, and cucumber grow well when soil temperatures are above 70°F.

Using Row Cover or Sprinkler Irrigation for Cold Protection of Strawberries

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

Strawberries growing in the matted-row system are in the blooming stage. Open flowers cannot tolerate temperatures lower than 30°F (Figure 1). Strawberry growers should be prepared for the coming low temperatures this week.



Figure 1. Strawberry flowers were killed by frost.

Row covers (Figure 2) can be effective in protecting strawberry flowers. In our earlier trial, 1.5 oz/sq row covers provided 4-6 degrees protection and successfully protected strawberry blooms in the earlier frost happened in middle April (the recorded lowest temperature was 24.5°F at Southwest Purdue Agricultural Center). Lighter row covers (0.05-1.0 oz/sq) provided fewer degrees of protection and double layers can be more effective. When using row covers for frost protection, be sure to have good soil moisture, sometimes running water through the drip line may add heat in the system. Apply row covers in the early afternoon to attract more heat before temperature drops. Although row covers can be effective in protecting strawberry blossom from frost damage, the drawback is they have to be pulled back during the day following a night of cold protection, as flowers need to be pollinated either by wind or insects.



Figure 2. Covering a strawberry field with a row cover.

Sprinkler irrigation is another option. It might be cheaper, less labor-intensive, and cover a larger area. When atmospheric condition is dry, start sprinkling when blossom temperature reaches 32 to 33°F. Keep running water past the sunrise, do not stop before the blossom temperature is registering 32°F. When using sprinkler irrigation for frost protection, it is critical to accurately measure blossom temperatures to guide the decision of when to start and shut off irrigation. Atmospheric temperatures may not always reflect actual blossom temperatures. Dr. Barclay Poling at NCSU recommended using a digital thermometer to measure blossom temperatures. [Here](#) is a video of Dr. Poling showing how to use the digital thermometer.

Asparagus Harvest and Grading

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

Asparagus is one of the first field-grown Indiana vegetables on the market. This article reviews harvest, grading and postharvest care recommendations to help you start the season with top quality asparagus.

Getting quality asparagus to market means making sure to pick good spears at the right time, grade according to your market requirements, and keep the spears cold, moist and upright.

Plan to harvest early in the morning when it is still cool. Spears to be sold should be tight at the tip, dark green, and at least 3/8 inch in diameter. During the harvest season the only spears left standing in the field should be those you expect to harvest in the future. Don't let unmarketable spears continue to grow and develop into fern. They can harbor diseases and insects, and also slow growth of new spears.

The grading of spears after harvest will depend on your market. The [USDA standards](#) presented here provide a reference for comparison to your grading criteria, whether or not your market requires USDA standards. The best asparagus is fresh (not wilted), straight, green (or other specified color) for most of the stalk length, and has a tight tip that is not spreading. The butt end is smooth and flat. Table 1 below summarizes the USDA standards for No. 1 and No. 2 grades, and Table 2 shows the various diameter classifications defined by USDA. According to USDA standards, minimum spear length may be specified to the nearest 1/2 inch but is not required. Spears are typically 7 to 9 inches. Figure 1 illustrates USDA criteria for asparagus.

Table 1. Asparagus grading criteria from USDA¹

Characteristic	USDA No. 1	USDA No. 2
Diameter	≥1/2 in., unless specified	≥5/16 in.
Color	at least 2/3 of stalk is specified color (e.g. green or purple)	at least 1/2 of stalk is specified color
Trimming	2/3 of butt of stalk is trimmed parallel to container, butt is not stringy or frayed	1/3 of butt of stalk is trimmed parallel to container; butt is not badly stringy or frayed
Straightness	Stalk is fairly straight	Stalk is not badly misshapen
Freshness	Not limp or flabby	Not limp or flabby
Damage ²	No damage	No serious damage
Decay	No decay	No decay

¹USDA-AMS Fruit and Vegetable Programs. 2006. [United States Standards for Grades of Fresh Asparagus](#).

²Damage may be caused by spreading or broken tips, dirt, disease, insects, or other means.

Table 2. Asparagus diameter classes from USDA¹

Class	Diameter measured 1 inch from butt
Very small	Less than 5/16 in.
Small	5/16 in. to less than 8/16 in.
Medium	8/16 in. to less than 11/16 in.
Large	11/16 in. to less than 14/16 in.
Very Large	14/16 in. and larger

¹USDA-AMS Fruit and Vegetable Programs. 2006. [United States Standards for Grades of Fresh Asparagus](#).

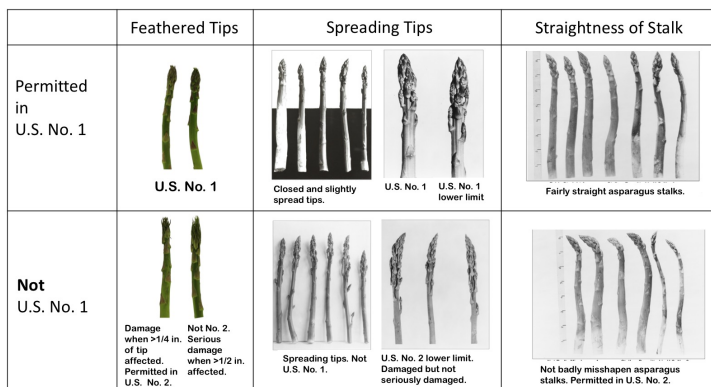


Figure 1. Visual Aids for Grading Asparagus from USDA. www.ams.usda.gov/sites/default/files/media/AsparagusVisualAids.pdf

Asparagus should be cooled as quickly as possible and kept cool. The optimum temperature range is 32°F to 35.6°F. To cool asparagus, it can be dunked in or showered with cold water. The water should be of drinking water quality and, if used more than once, changed regularly and disinfected using an approved material (see the [Safe Produce Indiana Resources](#) page for an [Excel tool](#) listing sanitizers labeled for produce). The harvested spears remain alive and actively respiring until they are cooked or eaten. Respiration creates heat and burns up carbohydrates. Keeping the asparagus cool reduces the rate of respiration, which is essential for maintaining quality.

High relative humidity is also important for asparagus. The desired range is 95% to 100%. If asparagus will be stored in a cooler, it may be placed in plastic bags to maintain high humidity. The butt ends of spears should be kept moist. They may be set on a moist pad or in 1/2 inch of water.

Improper storage conditions can lead to poor quality asparagus. Spears held horizontally for a period of time will bend upwards at the tips; it is best to hold spears standing up. Asparagus quickly gets tough if kept above 50°F. It will also get tough if exposed to ethylene gas. Ethylene may be produced by the asparagus itself if it is bruised, broken, or diseased. Low humidity will result in shriveling and weight loss. Asparagus will freeze at temperatures below 31°F, becoming watersoaked and mushy when thawed.

Experienced asparagus producers probably have a good sense of how much the crop will grow under different weather conditions. For those with less experience, Table 3 may help guide decisions about when to harvest. Is it necessary to pick every day, or is it ok to skip a day? The warmer the weather, the faster the spears lengthen. The table shows how many inches a spear will grow each day, depending on its size and the average temperature. For example, with a high of 70 and a low of 50, the average temperature would be $(70+50)/2=120/2=60^{\circ}\text{F}$. At an average temperature of 60°F, a 2-inch spear would grow 1.4 inches in one day, a 4-inch spear 2.0 inches, and a 6-inch spear 2.7 inches. After one day, the spears that started out at 6 inches would be ready to pick; after 2 days the 6-inch spears would be 11.4 inches, probably past the picking stage, and after two days the 4-inch spears would be 8 inches long and ready to pick.

Table 3. Spear growth of asparagus

Average Temp. °F	Size of Spear (inches)		
(High + Low) divided by 2	2	4	6
	spear growth (in. per day)		
50	—	0.6	1.3
55	0.7	1.3	2.0
60	1.4	2.0	2.7
65	2.1	2.7	3.4
70	2.8	3.4	4.1

Adapted from: Table 1. Estimating Spear Growth of Asparagus. in Carl J. Cantaluppi Jr. and Robert J. Precheur. 1993. Asparagus Production, Management and Marketing. Bull. 826. The Ohio State University, Columbus. p. 22.

Table 3.

Instructions on Finding the 24(c) Dual Magnum® Herbicide Label

(Stephen Meyers, smeyers@purdue.edu, (765) 496-6540) & (Liz Maynard, emaynard@purdue.edu, (219) 548-3674)

Dual Magnum® is registered for use in numerous row crops and specialty crops in the state of Indiana. While some vegetable crops (beans, peas, potatoes, pumpkins, rhubarb, and tomatoes) appear on the specimen or national label (Section 3 label), most do not. Numerous specialty crops that do not appear on the specimen label are included in the 24(c) special local need label. But finding the 24(c) label, which was recently updated in 2019, can be difficult.

The new 24(c) label is available on the National Pesticide Information Retrieval System web site:

http://npirpublic.ceris.purdue.edu/state/state_menu.aspx?state=IN. To find it, type "SLN IN" and "130003" in the first two boxes for "EPA Registration Number" and click the search button. The product report will show "DUAL MAGNUM - TRANSPLANTED BELL PEPPERS." Click on the ALLSTAR symbol. On the page that opens, click on the Company Label ID number "IN0816048DA0319." This will open a pdf of the label.

The active ingredient in Dual Magnum® is S-metolachlor. It is a soil-applied herbicide with activity on a wide range of grass and small-seeded broadleaf weeds. It is also one of few herbicides registered in specialty crops with pre-emergence activity on yellow nutsedge. However, it will not control emerged weeds and requires a rainfall or

irrigation event to be “activated” (moved into the soil where weeds seeds are actively germinating). Be aware that although generics of metolachlor (for example, Me-Too-Lachlor™) are available, their labels often do not include the crops covered by the Dual Magnum® 24(c) label. Consult each product label for information about registered uses and application rates. There may also be confusion with Dual II Magnum® (or variants thereof), which contains a safener specifically to improve crop safety when used in corn grown in cool soil conditions. For more information on chemical control of weeds, consult the *Midwest Vegetable Production Guide* at mwvegguide.org.

Giant Ragweed

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Scientific name: *Ambrosia trifida*

Giant ragweed is a weed member of the sunflower family (*Asteraceae*) and native to the United States. It is extremely competitive and difficult to control in broadleaf crops. It emerges as early as March and continues to germinate through spring and early summer. Controlling giant ragweed during summer is not only important for crops but also for human health because giant ragweed pollen can be an allergen for some people.

Identification: Seed leaves of giant ragweed are large and oblong. The first pair of true leaves are often unlobed and lance shaped (Figure 1). Subsequent leaves are large and three- or five-lobed with serrated margins (Figures 2 and 3).



Figure 1. Giant ragweed seed leaves and first true leaves. Photo by Stephen Meyers.



Figure 2. Young giant ragweed seedling with three-lobed leaves. Photo by Stephen Meyers.



Figure 3. Large three- to five-lobed leaves with serrated margins. Photo by M. Zimmer.

Growth habit: Erect summer annual, reaching 3 to 16 ft (Figure 4). Grows at approximately twice the rate of most annual weeds, and is likely to be 8 to 12 inches tall when other weeds are 3 to 6 inches tall.



Figure 4. Giant ragweed approximately three feet tall. Photo by B. Westrich.

Reproduction: Giant ragweed reproduces by seed and has separate male and female flowers. Both flower types are green-yellow in color and small. Males flowers appear on slender racemes in the upper terminals and females flowers are clustered in leaf axils. Each plant may produce as many as 10,300 seeds per plant.

Integrated weed management strategies:

Because giant ragweed emerges from very early in spring through summer, a single control measure is often insufficient for season-long control.

- Prevention: For fields with no history of giant ragweed, monitor fields and remove individuals before they set seed.
- Roguing: For small fields with low densities of giant ragweed, consider roguing plants that survive other control measures before they set seed. The seed of giant ragweed is not very persistent. It takes two years to deplete the seedbank by 99%. In large fields and at higher densities, this method will be cost-prohibitive.
- Cultural practices:
 - Crop rotation: Rotate to crops that require higher densities and in which you can use herbicides that can control giant ragweed.
 - Planting date: Depending on the crop, consider a delayed planting date. By allowing giant ragweed to emerge, it can be controlled at a young stage before planting with tillage or burndown herbicides. If time permits, a second flush could be allowed to emerge and be terminated before planting.
- Chemical control: Selection of proper herbicides and application method is essential because **herbicide-resistant** giant ragweed populations occur in Indiana. Populations of giant ragweed are resistant to group 2 (ALS inhibitors) and 9 (glyphosate) herbicides, making postemergence control difficult. For more information on chemical control options, consult the *Midwest Vegetable Production Guide* at <https://mwveguide.org/> and the product labels. Here are some general considerations:
- Consider combining pre-plant burndown or cultivation treatments with preemergence and postemergence herbicides.
- Soil-applied, preemergence herbicides will help to suppress

weed populations. Consider herbicides in the PPO-inhibitor family such as flumioxazin (ex. Valor®/Chateau®) and fomesafen (ex. Reflex®). These herbicides will require rainfall or irrigation to move them into the soil where weed seeds are germinating.

- Postemergence herbicide use relies on knowing if your giant ragweed population is herbicide-resistant. In general, postemergence herbicide options for broadleaf weeds are limited in vegetable crops. Auxinic herbicides such as 2,4-D (in sweet corn) and photosystem II-inhibitors such as Bentazon (ex. Basagran®) and metribuzin (ex. Sencor®) will provide some measure of control. ALS-inhibitors and glyphosate are options in susceptible populations. For all postemergence herbicide applications, target small weeds less than 4 inches tall.

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https://trace.tennessee.edu/utk_agexcrop/66

Keeping Produce Fresh at Markets and Farm Stands

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

Farmers markets and farm stands will be opening soon if they aren't already open. Vendors and market managers will be implementing new practices to reduce the spread of the novel corona virus. Guidelines for practices at Indiana farmers markets are summarized in a [new publication](#) from Purdue in cooperation with [Indiana State Department of Health](#), [Indiana Grown](#), and other organizations.

In addition to getting familiar with these new practices, it's a good time to review ways to keep produce fresh between harvest and sale. Vegetables quickly lose quality after harvest if not properly cooled and stored. Cooling slows biochemical processes in the harvested produce, helping to maintain flavor and minimize decay. Preventing water loss by maintaining appropriate relative humidity reduces weight loss and shriveling or wilting. Even when post-harvest care at the farm is adequate, keeping produce fresh at a farm stand or farmers market can be a challenge. Vegetables that look beautiful just after harvest can quickly lose their appeal after a few hours of sun and wind on a market stand. Consider these guidelines for keeping produce at its freshest.

1) Start with properly cooled produce. Avoid harvest during heat of the day if possible, keep harvested produce in the shade, remove field heat by cooling immediately after harvest, and store at proper temperature and relative humidity. See [p. 42](#) in the *Midwest Vegetable Production Guide* for 2020 for optimum storage conditions for a number of crops. For short-term storage, see Table 1 below, with vegetables grouped according to acceptable short-term storage temperatures.

Table 1. Acceptable temporary storage temperatures at relative humidity 85% to 95% and less than 1 ppm ethylene. Minimize ethylene by venting or scrubbing. Items in **bold** font are sensitive to ethylene damage.

32-36°F		45-50°F	60-65°F
Vegetables/Melons:	Fruit:	Basil	Ginger
Arugula	Herbs (not basil)	Cucumber	Melon (casaba, crenshaw, honeydew, Persian)
Asparagus	Horseradish	Eggplant	Onion (dry)
Beet	Kale	Melon (Juan canary)	Potato
Bok choy	Kohlrabi	Okra	Pumpkin
Broccoli	Leek	Pepper	Winter squash
Brussel sprouts	Lettuce	Snap bean	Sweet potato
Cabbage	Mustard greens	Summer squash	Tomato
Cantaloupe	Parsnip	Tomatillo	
Carrot	Pea	Watermelon	
Cauliflower	Radish		
Celery	Rutabaga		
Chard	Rhubarb		
Collards	Spinach		
Daikon	Sweet corn		
Garlic	Turnip		
Green onion	Turnip greens		

Source: Adapted from [Kitinoja and Kader, 2015](#), p. 218-219.

2) Provide shade at the market.

3) Provide windbreaks if market is in a windy location. Wind speeds water loss from produce. Water loss reduces the weight of the produce and results in shriveling or wilting.

4) Use ice for crops that tolerate it: asparagus, cole crops, leafy greens, leeks, green onions, beets, carrots, radishes, turnips, lettuce, sweet corn. Crops can be placed directly on crushed ice on a display table. At a farmers market it may be easier to rest produce on refreezable cold packs covered with a clean towel or ice in plastic bags. Ice should be made from potable water.

5) For crops that tolerate it, mist with clean cold water: broccoli, leafy vegetables, green onions, root crops, peas. Misting maintains high relative humidity. Water should be of drinking water quality and stored in a clean container.

6) Display in shallow containers to minimize bruising. Bruised produce will decay more quickly. Shallow containers are also more easily cooled.

7) Keep produce that is not on display as close to proper temperature and relative humidity as possible. It's not necessary to display all the produce at once. Consider displaying enough to get through busy periods and then restocking as it is sold to minimize the time produce is not under optimum storage conditions.

Farmers' Market Guidelines for Social Distancing

During the 2020 COVID-19 pandemic, farmers' markets and farm stands are considered 'essential businesses' in Indiana. Therefore, statewide Executive Orders permit their operation during periods when only essential businesses may remain open, as long as proper social distancing measures are used. The guidelines below outline best practices for farmers' markets in order to be considered an essential business. They have been prepared by Purdue in cooperation with [Indiana State Department of Health](#), [Indiana Grown](#), and other organizations.

As of May 4, 2020, the most recent [Executive Order](#) (20-26) permits [certain non-essential businesses](#) to open in all counties except Cass, Lake, and Marion. Appropriate social distancing, personal hygiene and cleaning/disinfecting continue. During the period of loosening restrictions we recommended contacting local health departments for guidance on best practices in your area. Conditions differ across the state of Indiana and so guidelines may also differ.

[Guidelines to Exercise Essential Status for a Farmers' Market](#) - by Purdue Extension, Spring 2020

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Best Practices for Infrastructure

- Sell only items currently designated as essential by the Governor's Executive Order
- Consider alternatives for:
 - Online ordering capabilities/payment systems
 - One-stop payment system (e.g., exchanging vouchers paid for in advance)
 - Designated pickup times
 - Drive-thru service (customers stay in vehicles)
- Discontinue all entertainment and youth activities
- Eliminate or cordon off gathering places
- Devote the first 30 minutes of market hours to elderly or immunocompromised customers
- Designate one market entrance and one market exit, if possible
- Limit traffic to one customer per vendor booth at a time
- Implement time limits for customers at each vendor booth
- Ask customers to remain in vehicles if lines begin to form
- Request that customers leave after completing purchases
- Ask that only one person per group enter the market
 - Allow exceptions for young children who cannot be left alone

Best Practices to Prevent Contamination

- Do not allow anyone to attend or work the market if they are ill, showing signs of illness or have had contact with someone sick/tested positive for COVID-19 in the last two weeks
- Promote social distancing by enforcing a 6- to 10-foot space between vendor booths
- Ensure people wear face coverings per U.S. Centers for Disease Control and Prevention recommendations
- Encourage proper social distancing restrictions of at least 6 feet between individuals
- Advise that everyone at the market wash their hands before and after attending
- Place rented portable hand-washing stations throughout the market
- Create hand-sanitizing stations and ensure all vendor booths have hand sanitizer
- Increase the frequency for disinfecting market surfaces/objects

Best Practices for Consumer Interactions

- Eliminate any eating while at the market — including product sampling
- Consider pre-packaged options for faster checkouts and smaller crowds
- Prevent customers from touching products they will not purchase
- Round prices to the nearest dollar to avoid making change with coins
- Encourage electronic payments whenever possible
- Bag products for customers to limit contact
- Split payment and bagging between two people
 - Alternately: bag first, then handle payment, then wash/sanitize hands
- Ensure that vendors wear disposable gloves to avoid contamination/touching their face *[the intent here is if you are handling money you should be using gloves]*

- Change gloves when changing tasks (i.e., don't handle money and products with the same gloves)

Best Practices for Communication

- Use social media and newsletters to promote:
 - Vendors
 - Products
 - New/existing policies
- Encourage customers to prepare advance shopping lists to minimize time in the market
- Post onsite signage reinforcing the following expectations:
 - **Do not** enter the market if you are ill, show signs of illness or have been in contact with someone sick/tested positive for COVID-19 within two weeks
 - **Do not** touch any product you do not intend to purchase
 - Remain in vehicles if lines begin to form
 - Maintain at least 6 feet between individuals per social distancing recommendations
 - Wear face coverings per CDC recommendations
 - Use hand-washing and/or hand-sanitizing stations
 - Leave the market after completing purchases

Please note that regulations are subject to change amid fluid developments in the COVID-19 pandemic response.

Ready for Winter to Be Over

(Beth Hall, hall556@purdue.edu)

The earth's position and movement around the sun welcomed the spring equinox on March 19th, and meteorologists in the northern hemisphere welcomed spring on March 1st. Unfortunately, the atmosphere – particularly over the midwestern and Great Lakes states – refused to acknowledge those dates to offer us a more traditional spring. Sure, Indiana's spring 2020 has been drier than 2019. The compromise to that gift, however, came with periods of below normal temperatures, and potentially below *freezing*, damaging conditions this Friday across much of state (Figure 1). This may not even be a one-and-done phenomenon as the National Weather Service is predicting a risk of much below-normal temperatures for the far northern counties in Indiana for May 13-15. Is Mother Nature aspiring to break low temperature records? The record latest dates for 32°F or lower minimum temperatures are mostly after May 15th, so we will just have to watch and see.

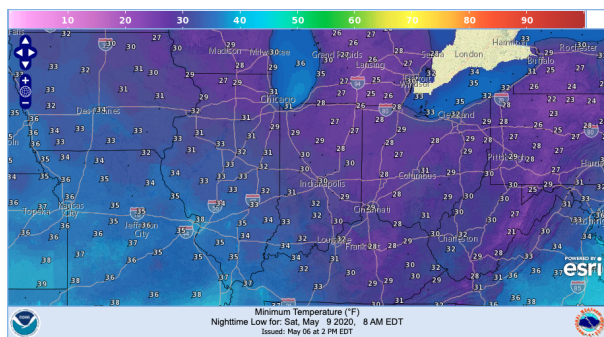


Figure 1. Forecasted minimum temperatures for early morning Saturday, May 9, 2020.

In addition to being unwelcomely cold, these below-normal temperatures have had two other effects. First, growing degree days

are accumulating at a slower rate. Currently, Indiana is about 50-80 units below normal modified growing degree-day accumulations (Figures 2 and 3). This has slowed a lot of plant growth and also kept soil temperatures cooler. The other effect is the reduction to evapotranspiration rates (Figure 4). April was drier than normal and May has not yet started to compensate for that. Looking at precipitation alone might lead one to assume agricultural drought is developing. However, cooler temperatures are helping to keep that moisture in the ground longer than what would otherwise be normal given the decreased precipitation.

Growing Degree Day (50 F / 86 F) Accumulation

April 1 - May 6

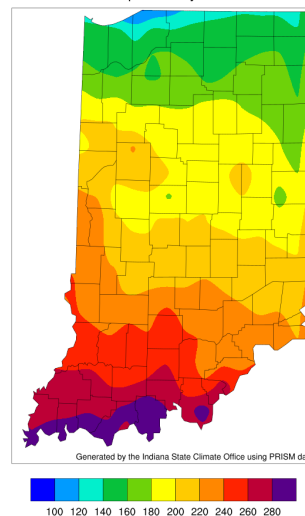


Figure 2. Modified growing degree-day accumulation for April 1 - May 6, 2020.

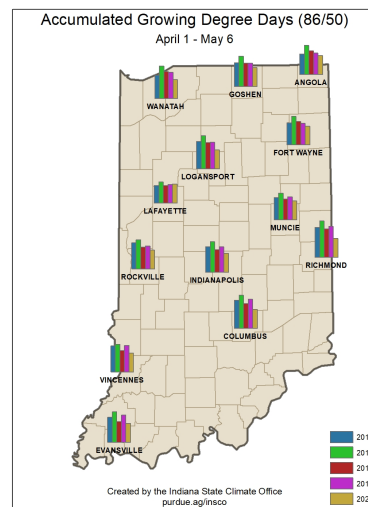
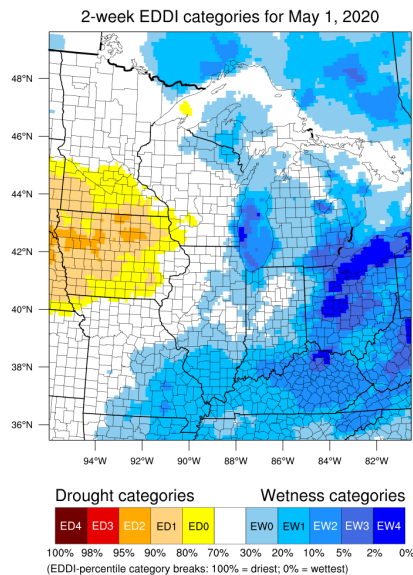


Figure 3. Modified growing degree-day for April 1 - May 6, 2020 compared to the previous 4 years.



Generated by NOAA/ESRL/Physical Sciences Division
Figure 4. Two-week Evaporative Drought Demand Index (<https://psl.noaa.gov/eddi/>) representing April 18 – May 1, 2020.

The climate outlook for May is predicting below-normal temperatures. The precipitation outlook is split across the state where the models are showing weak confidence for below-normal precipitation in the northern half of the state and too much uncertainty for the southern half (Figure 5).

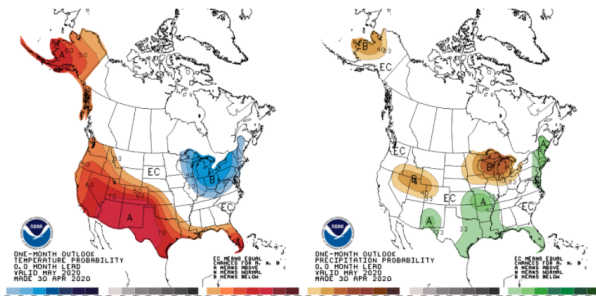
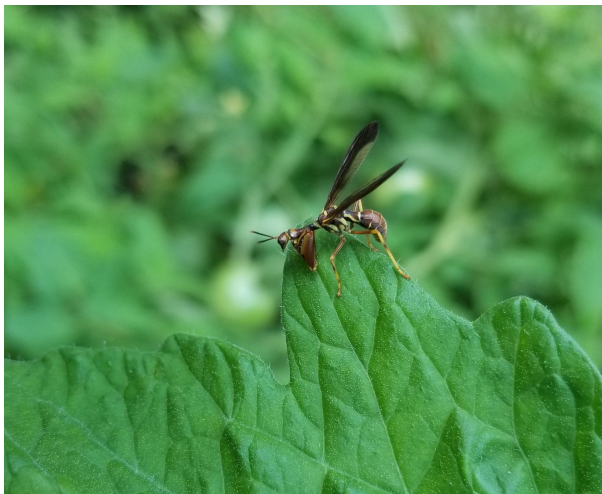


Figure 5. Climate outlooks for May 2020 that indicate the level of confidence for above- or below-normal conditions. Temperature outlook is on the left; precipitation outlook is on the right.

Question of the Issue (5-7-2020)

(Elizabeth Long, eylong@purdue.edu, (765) 796-1918)

What is this insect on my tomato plant? Is it a friend or foe?



Answer to Question from Last Issue (4-23-2020)

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



1. What caused the water-soaked stem of this watermelon transplant?

- A-damping-off
- B-gummy stem blight
- C-Lightening strike

Correct Answer: B

2. Is this problem likely to spread to other transplants? Yes

3. Will this problem likely spread in the field? Yes

More information about gummy stem blight can be found in the article [Cantaloupe and Watermelon Transplant Diseases](#) in this issue.

Small Business Administration Disaster Funds Webinar

This webinar will provide more information about the Small Business Administration Disaster Assistance funding opportunities for farmers and other small businesses. It will be held on May 7, 2020, 11:00am EST. If you can't view the webinar live, please consider registering to receive a link to the recording.

[Navigating the SBA Disaster Funds Webinar \(May 7th at 11am\)](#)

[Register for free here!](#)

<https://ag.purdue.edu/Extension/wia/Pages/webinars.aspx>

Great Lakes Vegetable Producers Network

Purdue Extension is participating in the [Great Lakes Vegetable Producer's Network](#), a live weekly roundtable discussion during the growing-season for commercial vegetable producers in the Great Lakes and Midwest region. Join us! We broadcast live via Zoom at 12:30 ET/11:30 CT every Wednesday from the first week of May to the first week of September.

If you have a pressing vegetable production issue that you would like discussed, simply email it, along with your phone number, to greatlakesvegwg@gmail.com.

GREAT LAKES VEGETABLE PRODUCER'S NETWORK



Join Zoom live online or over the phone with the following information at

12:30 ET/11:30 CT every Wednesday

Join online: bit.ly/glvpnlive

Or call in: US: +1 312 626 6799 | Canada: +1 647 374 4685

Enter meeting ID: 936 7176 7610

Get the latest information or subscribe to get email or calendar reminders at

www.glvveg.net/listen



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