High and Dry

Growing Vegetables in Northern New England High Tunnels

University of Vermont | Extension
College of Agriculture and Life Sciences

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WELCOME TO THE SEVENTH ISSUE of *High and Dry: Growing Vegetables in Northern New England High Tunnels,* a quarterly newsletter linking growers, researchers, and agricultural service providers to enhance protected crop production. After a particularly hot summer, this issue offers some great strategies for managing heat stress in future growing seasons, as well as some exciting info about beneficial parasitoids that you want to keep around!

This online newsletter is a collaborative effort among the University of Vermont (UVM), the University of New Hampshire (UNH), and others to support high tunnel growers — especially new ones who are still gaining experience with this technology. Our goal is to provide information and resources to help your high tunnel crops thrive! There is loads of great information to explore in previous issues — search the archives here.

Don't hesitate to reach out to the team listed on the last page with ideas for future topics, feedback, or questions. This work is funded by the Northeast Sustainable Agriculture Research and Education (NE-SARE) program and the UVM and UNH Extension programs.

High Tunnel Production Conference: Enhance YourTunnel Vision

December 10–11, 2025

Fireside Inn and Suites
West Lebanon, NH 03784

Calling all high tunnel growers!

Whether you are a new or experienced high tunnel grower, plan to join UMaine, UNH, and UVM for this two-day event. Come learn from experts and other farmers, talk with vendors, and see their products at the trade show. This conference will offer useful information for high tunnel growers and agricultural service providers of all experience levels and all crops.

Learn more and register online by December 3.

https://go.uvm.edu/unh-high-tunnel

Tell Us What You Really Think!

For two years the Northeast High Tunnel Team has produced seven newsletters filled with information to help you grow better crops in your high tunnels. This was funded by the Northeast Sustainable Agriculture Research and Education Program (SARE). We are now seeking feedback from you to find out if these newsletters are useful and whether we should continue to produce them in the future. We also would like to know how we could make them more useful and what other tools would help you with high tunnel production. Please complete this QUICK survey to tell us what you think.

https://qualtrics.uvm.edu/jfe/form/SV_09eYUM3RY5AsjoG

Too hot to grow? Deciding when and how to shade your high tunnel

Jonathan Ebba, UNH Landscape and Greenhouse Field Specialist

SUNLIGHT IS ELECTROMAGNETIC RADIATION in a mix of different wavelengths. We call these different wavelengths things like "blue", "orange", "ultraviolet" or "infrared" (or even "microwave" or "gamma waves", but we'll not address these in this article!). Plants primarily use red and blue light for photosynthesis, while infrared radiation is absorbed as heat.

Something provides shade when it blocks some of light from hitting the surfaces below. It can do this by reflecting the radiation back up or by absorbing the radiation into itself. This is why shade is both cooler and darker.

There are two reasons why we might want to shade a tunnel: First, we might shade to reduce the amount of sunlight hitting our plants. Too much light can overwhelm photosynthesis resulting in plant injury ("sun scald") and stress. Second, we might shade to reduce heat buildup. Too much heat in a tunnel can result in heat stress, blossom drop and reduced growth for plants, not to mention reduced well-being and productivity for the humans working inside it.

These goals are not always the same. A grower may want to lower heat while maintaining light (e.g., tomatoes in early September), or prevent sunscald while keeping warmth (e.g., those same tomatoes in late spring). Shading strategies should therefore match both crop and season. A word on limitations: shade can reduce the incoming heat load and make ventilation more effective, but no amount of shade can correct poorly designed ventilation! Let's look at the two most common methods of shading a greenhouse or tunnel in the northeast: shade compounds and shade fabrics.

Shade compounds

These are liquid coatings, often applied with a sprayer. They gradually wear off throughout the growing season but can be removed with a release agent and a subsequent rainfall. Although typically seen on glass and rigid polycarbonate greenhouses, these compounds can be used on poly houses as well.

Shade compounds provide effective cooling without trapping heat. Shade density can be adjusted by how thickly they are applied. A nice benefit is that they wear-off gradually… reducing the amount of shade provided as the season progresses… as the sun provides less light, the

Figure 1. Black shade cloth pulled over a greenhouse.

Figure 2. White shade cloth pulled over a greenhouse.

compound shades less, until it wears off (or is removed) entirely. They can be reapplied over a partially worn-off coat to darken it again.

Shade compounds can be messy and time consuming to apply and remove and require some skill and equipment and some growers don't like the general appearance of "whitewashed" houses.

Different formulations are available: some reflect IR while transmitting wavelengths used for photosynthesis, others are designed to scatter the light that gets through, providing more even distribution. Some formulations are meant to be applied on top of an existing coat for a short-lived protection from a hot spell.

Shade cloth

This is likely the most common shade method used on tunnels in New England. These are woven fabrics that are usually stretched over the outside of the tunnel, though they may also be hung inside. Note that shade cloth inside the house will be less effective at cooling, because light absorbed by the inside cloth becomes inside heat.

Shade cloths are characterized by the percentage of light they block. A "90% fabric" will block 90% of the light coming through, while a 30% fabric will block just 30%. Common percentages are 30%, 50%, 70%, 80%; others are available.

It's interesting to note that this transmission percentage pertains to the light in the wavelengths useful for photosynthesis (PAR), not to the total amount of radiation passing through the fabric. As such, it's possible that a 50% shade fabric will block 50% of the light for photosynthesis but may block a lesser amount of radiation that is causing heat.

The greenhouse industry utilizes energy curtains: these fabrics are retractable and installed on the inside of the greenhouse. They can be used for shading during peak sun and for insulation at night. As these systems become more common for smaller greenhouses, look for them to become more available for high tunnels.

Color

The color of cloth affects both durability and heat dynamics.

White cloth reflects more heat than black at the same percentage, keeping tunnels cooler. It is typically more expensive with slightly shorter lifespan.

Black cloth is more affordable and durable but absorbs heat and can keep tunnels warmer. This may be desirable in the shoulder seasons.

Aluminized cloth is highly reflective, lowering temperatures more effectively than white. It also diffuses light for more uniform photosynthesis and provides nighttime insulation but is less durable and more costly.

We have recently seen colored shade cloth, particularly red or blue, gaining in popularity. The color of the cloth corresponds to the wavelength of light that is transmitted through the cloth to the crop below. Since photosynthesis uses principally light in the red and blue wavelengths, these cloths can absorb wavelengths that would simply be converted to heat, while transmitting wavelengths that will be used for photosynthesis. Some growers utilize red shade cloths for tomatoes, peppers and other flowering crops, while others use blue cloth for leafy greens.

Decision making

Shade is a tool, and like any tool, its effectiveness depends on correct application. First, identify the crops and the dates that you are considering shading. This will dictate if you are trying to reduce heat, reduce light, increase insulation or some combination of these.

Remember that as you reduce the amount of light that is causing heat, you are also reducing the amount of light that plants need to grow. A tomato growing in a shaded tunnel may have plenty of light in July, but the same plant in the same house may be light deprived come late September.

Light reduction will be based on percentage, regardless of material.

- Don't choose a higher percentage shade than you need.
- White will cool the house more during the day.
- Black will warm the house more.
- Either will provide limited insulation to the house at night.

If you are trying to maximize light penetration while minimizing heat gain, or if you are trying to achieve something fancy with wavelength, blue or red may be worth the investment for you.

Apply shade only once adequate light is available and remove it when the days shorten and before the crop no longer receives adequate light.

Based on changes desired to light and heat, consider the following matrix. These are hypothetical; the percent reduction of the material we select will be based on the amount of shading required.

Hypothetical selection matrix for shade cloth based on desired outcome:

OBJECTIVES	INCREASE HEAT	DECREASE HEAT
MAXIMIZE LIGHT	black or red 30%	white 30%
MINIMIZE LIGHT	black 80%	white 80%

Proper application of shade can result in healthier crops, higher yields and happier employees, but the type of material used and the plan for application need to be based on crop and schedule and planned beforehand.

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High and HOT — Managing Heat Stress in High Tunnels

Ann Hazelrigg and Becky Maden, UVM Extension

The summer of 2025 is barely behind us, leaving a lot of lessons learned about how to manage tunnel crops during hotter, drier summers. For most warm season tunnel crops (peppers, eggplant, tomatoes, cucumbers), optimum growth temperature is between 70°–75°F. Above 85°F, plant growth slows and stress symptoms such as wilting, marginal scorch, leaf roll, bud abortion and decreased fruit set may develop. According to the National Weather Service (weather.gov), Burlington, VT had 9 days in June, 18 days in July, and 14 days in August over 85°F, with temperatures often exceeding 90°F. During these stretches of intense heat, crops can suffer stress and damage, resulting in decreases in yield and crop quality.

Blossom end rot in tomatoes.
Photo: Meg McGrath, Cornell University

Impacts of heat

High temperatures affect mechanisms that are important in photosynthesis and water balance resulting in smaller plants and lower yields. Flowers and fruit are more sensitive to high temperatures than leaves and stems; when high temperatures occur 1–2 weeks before flowering, abortion of buds and dropped flowers will be evident, leading to gaps in harvest. Daytime temperatures over 90° F can cause problems in pollen and nighttime temperatures over 70° F can also lead to bud drop and flower abortion. In most fruiting crops, this can lead to either losses of fruit sets and/or distorted fruit.

Once fruit has set, high heat can diminish fruit quality (often linked to water and nutrient uptake) such as yellow shoulders, uneven ripening, blossom end rot, cracking and misshapen fruit. Sunscald is the physical damage caused by direct sun on mature fruit, especially common when there is no foliage protecting fruit. High temperatures can also increase relative humidity, increasing the risk of foliar disease. Leafy crops are also negatively impacted by heat, leading to bitter flavors and/or premature bolting.

Yellow shoulders due to heat stress and high temperatures. Photo: Kristine Lang

Tips for managing hot conditions

Irrigation. Water needs are higher with high temperatures, especially during fruit production, so growers need to increase or adjust the frequency, timing, and amount of irrigation during heat spells.

Improve tunnel ventilation and circulation. Create openings to allow hot air and humidity to escape from the tunnel — remember, hot air rises so peak vents, butterfly vents, or ridge vents are all good options. It's also important to circulate air through the tunnel to cool the air and keep it fresh around the plants — this is especially important during peak plant growth to provide optimal CO_2 when the plants need it most for photosynthesis. More about ventila-

tion and circulation can be found on **UVM's Ag Engineering Blog**.

Shade cloth or greenhouse paint. During peak heat, shading the tunnel can relieve heat stress. See the article by Jonathan Ebba in this issue of High and Dry!

Cultivar selection. Heat tolerance can vary by cultivar, with some being more tolerant of high temperatures than others. Ask seed reps for recommendations and pay attention to what varieties do well under heat stress.

Keep humans cool. If it is too hot for crops, it's probably too hot for people. Adjusting work hours and making sure farmers and workers are hydrated is critical. **Read here** for more about avoiding heat stress for farm workers. (**Portable neck fans** might just be an essential greenhouse tool in this era of climate change!)

In summary, high tunnels are an excellent tool for protecting crops from most weather elements, but once the outside air is above a certain temperature, crops in tunnels can be at risk of heat stress. For most high tunnels, it is not practical or cost effective to actively "cool" the tunnel, but by planning ahead and implementing the strategies noted above, your crops can survive, and even thrive, during hotter summers.

Upcoming Events

2025 Northeast Greenhouse Conference & Expo
November 12 & 13, 2025
Doubletree by Hilton Manchester Downtown Hotel and Expo Center
The biennial Northeast Greenhouse Conference & Expo is co-sponsored by New England Floriculture, Inc. — a group of grower representatives from the Northeast, augmented by University and Cooperative Extension staff in each state who specialize in greenhouse crops and management. This is a great opportunity to learn, share and connect with other industry professionals! There are educational tracks on Disease and Pest management, Business & Marketing, Hydroponic Production, Soilless Substrates, Floriculture Production, Cut Flowers, Small Fruit Production, among others. Also included is an exciting Trade Show with many exhibitors!

UVM Pesticide Education and Safety Program 2025 Back to Basics CORE Essentials Webinar Series
This webinar series is focused on the Cornell (NY) Core manual used by Vermont and does include some Vermont-specific regulations. The primary audience is Vermont-certified pesticide applicators. Participants can still attend from any New England state if interested. There is a cooperative agreement where recertification credits earned in any New England state are accepted by the other New England states.

October 28, 2025: Pests, Pesticides, Environment
November 4, 2025: Risk, Response, PPE, the Label
November 11, 2025: Formulations, Calibration, Mixing
November 18, 2025: Regulations, Storage, Transport
all sessions Virtual via Zoom

Biocontrol Blitz: Fundamentals for using Good Bugs in the Greenhouse

North Country Farm and Homestead Conference

A Biocontrol Starter Pack

NH License Preparation for Private Applicators

A Problem Pest in Peppers: Pepper Maggot, Zonosemata electa

Margaret Skinner, UVM Extension Entomologist

In late July, the owner/grower of Otter Point Farm in West Haven, VT sent pictures of a maggot he found in peppers growing in his high tunnel (fig. 1). He reported that damage from this pest had wiped out the first few weeks of his harvest (fig. 2). He had never seen it before, though he has grown peppers in the same high tunnel for several years.

Fig. 1. Maggots within rotting pepper (top) and a larva with black mouth-hooks, a characteristic of some fly species (bottom). Photo: Scott Hertzberg

This damage is caused by the pepper maggot, *Zonosemata electa,* in the family Tephritidae, commonly called fruit or peacock flies. Tephritid flies are often colorful and usually have patterned or banded wings. As is the case for pepper maggot, which has three yellow stripes on its back, some species show Batesian mimicry by looking like a yellowjacket wasp (fig. 3). Female pepper maggot adults are about the same size as a house fly; males are a bit smaller.

The pepper maggot is native to eastern North America and is believed to have moved from weedy perennial horse nettle, *Solanium carolinenses,* to cultivated solanaceous crops, including eggplant, tomato, and their favorite host, pepper. It only attacks plants in the family Solanaceae, but that includes over 2,500 different species, so they have lots to choose from.

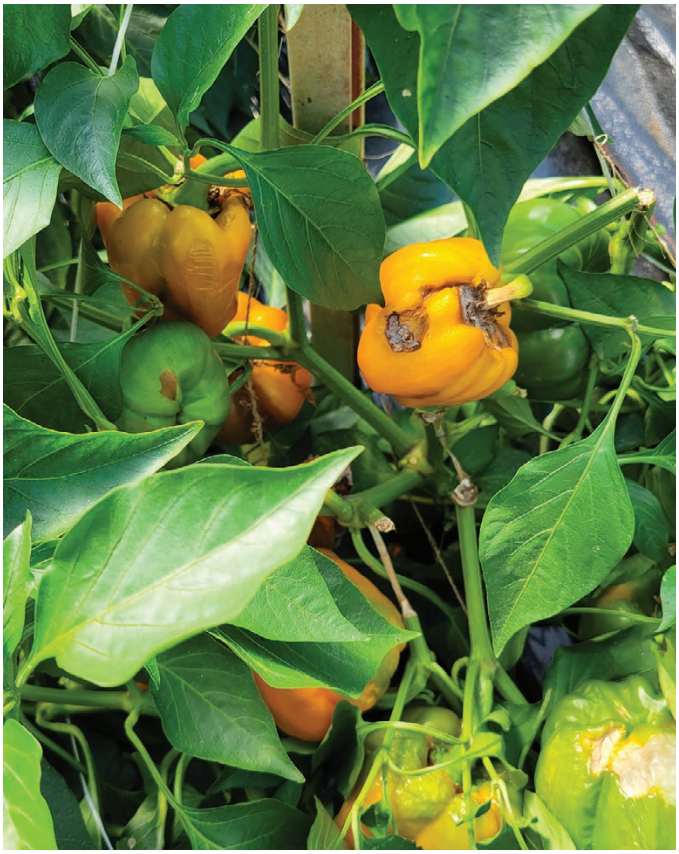

Fig. 2. Heavy damage from pepper maggot in high tunnel peppers. Photo: Scott Hertzberg.

Biology. The pepper maggot has one generation per year. Adults begin to emerge as early as the June or mid-July period. Under field conditions they gather along hedgerows or field edges to mate. In a high tunnel, it is likely the life cycle begins earlier. The female begins to lay eggs 6–7 days after mating, finding a suitable host fruit in which to lay eggs (oviposit) (fig. 4). On average one female can lay 54 eggs. Eggs are laid when the fruit is very small, less than 1 inch diameter. After around 10 days, the tiny light-colored eggs hatch into minute yellow to creamy-white, fleshy maggots with two black mouth-hooks, and no head capsule (fig. 1). The maggot tunnels into the fruit, feeding on the soft inner tissue and bringing

with it decay organisms that cause the fruit to rot. It feeds over the next 2–3 weeks, reaching around a ½ inch long. Maggots usually exit the fruit at the blossom end, leaving a soft decaying fruit behind. They drop to the soil and burrow to a depth of 2–5 inches to pupate. The pupa is a small blackish-brown, ridged cylinder (≈0.3 inches long).

Fig. 3. Pepper maggot preparing to oviposit on a young eggplant. Photo: M. Richman, Reston, VA, from inaturalist.org.

Damage. Pepper maggot is a problem in both field and high tunnel-grown crops, though the timing of infestation varies with location and temperature. In Scott's case, he observed heavy damage in his high tunnel peppers in late July, which suggests the adults may have emerged from their overwintering sites in late June or early July. The incidence of this pest is reported to be patchy and sporadic. Some farms have high populations and others don't, and outbreaks vary from year to year. Because the pest attacks early they may go undetected before they exit the fruit. Growers may mistake the damage as that of European corn borer, but the larva of the borer has a distinct head capsule, not mouth-hooks.

Cultural control. It may be easier to manage pepper maggot in a high tunnel than in the field because the habitat is easier to control. Sanitation is the first line of defense. Rotten peppers should be picked up and disposed of in the garbage, fed to farm animals or buried deep in the compost pile). Tilling the soil to a depth of 5 inches after the crop is finished will disturb or kill the larvae and pupae. Pulling up and destroying alternate hosts, such as horse nettles, in and around the growing area will reduce populations. Growing resistant cultivars may also minimize the problem. Females prefer fleshy pepper varieties, including bell and cherry peppers. Thin-walled Cayenne, Jalapeno, Tabasco, banana and Serrano peppers are less preferred hosts. If possible, rotate peppers and other solanaceous hosts to a new site if the pest has been observed. Laying plastic or weed cloth around the plants will prevent larvae from entering the soil. Plants can be covered with insect netting during the egg-laying period if it is certain they are not overwintering in the nearby soil.

Fig. 4. Pepper maggot oviposition site (indicated with circle) and exit holes at the blossom end.

Scouting. The color of the adult flies is distinctive and thus can be distinguished from other flying insects. They can be trapped on yellow sticky cards placed around the host crop. Interestingly, it is recommended to use commercial apple maggot traps around sugar maple trees. Apparently, adults aggregate around these trees to feed on the pollen and nectar before mating. The pest can also be

monitored by looking for fruit scars left after the female lays her egg (FIG. 4). Hot cherry-pepper varieties, a preferred host, can be used as a trap or indicator plant by growing them in one area of the high tunnel, and scouting them for egg scars. If they become infested, they should be removed and additional treatments for the crop plants considered.

BIOLOGICAL AND CHEMICAL CONTROL. To protect the current crop, treatments must target the adults because eggs and larvae are protected within the fruit. To properly time treatment, it is essential to scout for adults in the crop. Several insecticides are registered for this pest, including those containing synthetic pyrethroids or spinosad. Consult the New England Vegetable Management Guide for specific materials: https://nevegetable.org/crops/pepper/insect-control. Pesticides can be used on high tunnel and greenhouse crops if: 1) the crop and pest/disease is on the label, AND the product label specifically states it can be used in the greenhouse; OR, 2) the crop and pest/disease is on the label, AND the product is 'silent' about use in the greenhouse. Products that specifically prohibit greenhouse use cannot be used in greenhouses or high tunnels regardless of the crops or pests/diseases listed on the label.

The nematode, *Heterorhabditis bacteriohora,* is reported to seek out maggot larvae in the soil. Nematodes can be applied to the soil around plants about 1 month after adults are first observed to target the larvae as they exit the fruit. This treatment will not protect peppers that are already attacked but may reduce pest populations in the future.

CONCLUSIONS. Pepper maggot is one of those pests found commonly in southeastern states but appears to be moving northward as our climate warms. This is an example of a pest that may become a more serious problem in high tunnel production because soil tilling is minimized and environmental conditions are moderated. Farmers should add pepper maggot to the list of pests they look out for in their field and high tunnel crops. Accurate identification of the pest is critical to determine the best treatment to consider for management.

Additional information

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What's That Bug? Hornworm Parasitoids

Cheryl Sullivan, University of Vermont
Entomology Research Laboratory

If you grow tomatoes, you're probably familiar with hornworms that often cause extensive defoliation to plants. Tomato *(Manduca quinquemaculata)* and tobacco *(Manduca sexta)* hornworms are the caterpillars of Sphinx (or Hawk) Moths (Sphingidae family). The caterpillars are simple to tell apart. Tomato hornworms have eight white Vs on their sides and a black horn (photo 1). In contrast, tobacco hornworms have seven white stripes and a red horn (photo 2).

Photo 1: Tomato hornworm caterpillar. Image by Whitney Cranshaw, Colorado State University, Bugwood.org.

Photo 2: Tobacco hornworm caterpillar. Image by Cheryl Sullivan, UVM.

Hornworms have several natural enemies. General predators like lady beetles and lacewings will prey on egg and young caterpillars. Older caterpillars are prime targets for wasp parasitoids. "Parasitoids" are organisms that develop on or within a host, eventually killing it. In contrast, "parasites" do not kill their hosts. photo 3 shows a tobacco hornworm that was parasitized by a native Braconid wasp parasitoid called *Cotesia congregata.* The adult wasps lay their eggs within the hornworms. After the eggs hatch, larvae feed inside the hornworm. Larvae then chew a hole in the hornworm's skin and emerge to pupate in cocoons on it's surface. The cocoons are often mistaken for eggs.

If you look closely, a hyperparasitoid (a parasitoid of the parasitoid) is lurking. The hyperparasite is a Chalcid wasp (Chalcidoidea superfamily) in the Pteromalidae family, possibly *Hypopteromalus tabacum.* This is unfortunate for the developing Cotesia wasps. Hyperparasitoids can cause significant mortality to beneficial parasitoids, hindering effective biological control of the pests.

For more information, visit the following links:

- A Complex Story: Disappearing Tomato Leaves, a Tiny Wasp, and a Virus (Ohio State University)
- A Parasitoid Wasp Cotesia congregata (Say) (Insecta: Hymenoptera: Braconidae) (Univ. of Florida)
- Cotesia Wasp (NC State)
- Hornworm, Tomato (UMASS)
- Hyperparasitoids (NC State)

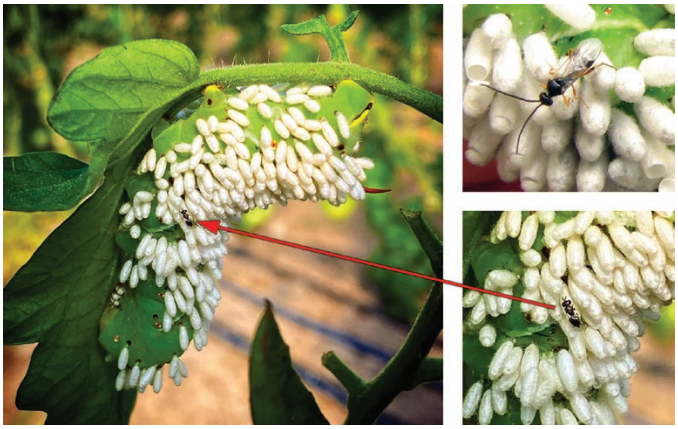

Photo 3: Tobacco hornworm parasitized by Cotesia congregata (left). A hyperparasitoid is visible on the cocoons (bottom right). Photo by Cheryl Sullivan, UVM. Adult Cotesia congregata wasp (top right). Photo by Beatriz Moisset, BugGuide.

Mystery Solved!

Heather Bryant, Field Specialist, UNH Extension

Will Hastings, UNH Field Specialist and I are conducting a tunnel cover crop trial at my office this summer. We followed the cover crops with a late crop of tomatoes to measure the impact of the cover crops on yields. No sooner did we plant the tomatoes when this mystery insect moved in!

Chalcidoid wasp. Photo: Dr. Amber Vinchesi-Vahl

I first noticed it sitting on the lower stems of the tomatoes within a week of planting. Within a couple weeks there were 10 or more of them on nearly every plant in the tunnel. They are tiny and even with a hand lens I couldn't get a very good look at them. To my eyes they looked like a winged ants, and initially I was concerned they were there to feed on the tomatoes. But as time went on I couldn't see any evidence of them doing anything other than sitting nearly motionless.

Will and I invited Amber Vinchesi-Vahl, our State Entomology and IPM Specialist for a visit to see if she could learn more. She was fairly sure it was some sort of parasitoid wasp, and took some photos back to her office to try to find out more. She determined it was a chalcidoid wasp. Chalcidoid wasps are part of the Chalcidoidea superfamily of parasitoid wasps with many species. It also turns out there are some species are hyperparasitoids or parasites of parasites. As an entomologist Amber was intrigued, but since a parasitoid that will kill a pest is more useful to our project, Will and I were less enthused.

We sent a sample of the insects to Istvan Miko an Entomologist at UNH. Istvan and his graduate student, Shyloh Favreau, determined it was chalcidoid wasp most likely in the genus *Pseudometagea,* family Eucharitidae. Happily they are not hyperparasitoids, they typically attack ants. And sure enough, when I looked around the ant population had decreased! I've had a large population of ants in the tunnel for years, but since they rarely do any damage other than minor feeding on seedlings I had been leaving them alone.

While the major mystery has been solved, we're left with a few intriguing side questions. The ants have been there for years so why did the parasitoids choose now to move in? Will they stay or is this a one-time happy occurrence? Istvan and Shyloh are curious about the ants, so I sent them a sample. I'll update you in a future issue if they find out more!

To Learn More

Parasitoid Wasps
https://extension.umd.edu/resource/parasitoid-wasps/

Hyperparasitoids
https://entomology.ces.ncsu.edu/biological-control-information-center/beneficial-parasitoids/hyperparasitoids/

The Great Flip: When to call it on summer crops?

Becky Maden, UVM Extension

MID-AUGUST MARKS AN ABRUPT CHANGE in ripening patterns in warm season high tunnel crops. As the nights lengthen and temperatures drop, there is a noticeable slowdown; yields decline and ripening time increases. These abrupt changes often leave growers considering the opportunity costs of leaving in summer crops versus planting fall and winter greens. In other words, it is very tempting to rip out the old plants and start fresh!

While high value summer crops can look a ragged by the end of August, if you estimate the volume of ripening fruit, it may be surprising to learn that the plants still hold significant value. For example, if each leader on a tomato still had 6 high quality fruit left on it to ripen, this roughly equals 3 lbs. of fruit, with an approximate value of $3.50 / lb.; planted at an average density of 5.5 sq ft/ stem (Grubinger, unpublished) in a 2700 sq ft tunnel, this equals over $5,000 in potential sales on the vine. Allowing this fruit to ripen if the market is available for these sales may well be worth it.

Deciding when to rip out summer crops is influenced by other factors besides crop value, including labor (college kids are leaving!) and markets (will tomatoes sell in October?). In reality, there is a finite amount of time that summer crops can linger without completely losing the opportunity to establish a winter crop, so having a production plan in advance can help set deadlines for summer crop removal.

Winter growing pioneer Eliot Coleman established that once day length drops below 10 hours per day (the start of the "Persephone period") greens stop growing. This date is the marker from which you work backwards to determine seeding dates for winter crops. At my farm in Orwell, Vermont, November 6 is the last day with 10 hours of day length, so I use that date to count backwards using these **useful charts in Johnny's Selected Seeds**. I can then create my own simple seeding chart, specific to my latitude:

Winter Greens Seeding Dates			
	DATE 1	DATE 2	DATE 3
KALE (FULL)	7/24/2025	7/31/2025	8/7/2025
KALE (BABY)	9/18/2025	9/25/2025	
TATSOI	9/4/2025	9/11/2025	
SPINACH (FULL)	9/11/2025	9/18/2025	
SPINACH (BABY)	9/25/2025	10/2/2025	
BABY LEAF BRASSICAS	9/25/2025	10/2/2025	
CLAYTONIA	9/11/2025	9/18/2025	
CILANTRO	8/28/2025	9/4/2025	9/11/2025
ARUGULA	9/25/2025	10/2/2025	
MIZUMA	10/2/2025	10/9/2025	
LETTUCE (BABY)	8/28/2025	9/4/2025	
RADISHES	8/28/2025	9/4/2025	9/11/2025

It's important to note that these are seeding dates--so transplants can build in a time cushion between summer and winter crops. It may seem like an extra step to transplant crops like spinach or mustard greens, but this system can allow those last 6 fruit on each tomato vine to ripen, and earn that additional $5,000! Paperpot transplanters may be a worthwhile investment to help facilitate rapid transplanting without much labor. The aim of these planting dates are to size up crops enough for winter sales. However, on the other side of the Persophene period, which is February 5 where I live, growth begins again. So as long as crops that were harvested in the fall or were immature going into the winter are able to survive the cold temperature, new growth will begin growing again as the days lengthen throughout February and March.

What does all of this mean in terms of flipping tunnels in the fall? Strike a balance — if there is value in summer tunnel crops, leave them as long as you can, and you might be surprised by the rewards of a couple extra weeks in the ground. Use transplants when you can. And don't be shy about planting late — as long as you can get the crop to establish and survive the winter, you'll recoup the value on the other side. Finally, living roots are important for healthy tunnel soils — so if you can't get greens established, broadcast a cover crop to keep those microbes fed for the winter!

For an excellent overview of winter planting including specific dates, watch **Vermont Vegetable and Berry Growers winter webinar**. And don't miss the winter greens farmer to farmer session at the **High Tunnel Conference** December 10–11 in West Lebanon, NH!

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