UMass Extension

Vegetable Notes

For Vegetable Farmers in Massachusetts since 1975

Volume 31, Number 4 March 28, 2019

IN THIS ISSUE:

Mustard greens and arugula seeded in a low-till high tunnel at Gaining Ground Farm in Concord, MA. Tilther and broad-fork used for bed prep. Photo: C. Roszell

CROP CONDITIONS

The subsoil scramble has begun. Farmers are preparing to subsoil in order to speed up drainage and sprucing up tillage implements to get in the ground as soon as the soil thaws and drains. Otherwise, it's difficult to tear farmers away from their greenhouses this time of year. Alliums are well on their way in small-celled trays, and some early season brassicas have sprouted as well. See Pest Alerts below for advice on how to prevent algae in these trays.

Spring parsnips are being dug, yum! The last of winter stored crops – alliums, roots, butternuts – are making it out to market. Meanwhile, garlic was seen sprouting in Middlesex Co. this week. Those making use of season extension structures are enjoying rapid re-growth from overwintered spinach that has already been harvested twice, thrice, or even four times this winter. Soon though, these winter greens will begin to bolt, and in a few weeks, high tunnels will be turned over to tomatoes and cucumbers, if they haven't been already. In caterpillars, rolling tunnels, and high tunnels this past week we have seen healthy carrots and mescaline mixes that have germinated and transplanted peas. One farm is making use of the paper pot transplanter and liking it so far because it helps them get early season crops into the ground even earlier.

PEST ALERTS: ALGAE IN TRANSPLANTS

Onions and leeks are some of the earliest crops to be seeded in the greenhouse. Every year we get calls about poor stands and green growth or crust forming on soil in transplant trays. The green growth is algae, which can grow on any greenhouse surface and comes in on dust or irrigation water. Algae thrives in sunny, wet areas with high organic matter, e.g. an overwatered tray full of potting media, especially if the media is compost-based or contains a lot of peat. Algae do not harm plants directly, but can slow gas exchange through media, thereby slowing root growth. Algae also attracts fungus gnats and shore flies, which not only feed on algae and other fungal growth in the growing medium, but also on plant roots, creating wounds where pathogens might gain entry into plant roots. Once you have algae it is hard to get rid of, so how can you prevent algae from growing?

Pre-season cleaning and managing moisture are key in preventing algae in greenhouses. Algae doesn't need potting soil to grow in a greenhouse – it can grow on any moist surface – so thoroughly cleaning and sanitizing your greenhouse benches, floors, trays, and any other surfaces in your greenhouse can help reduce algal "inoculum". Manage moisture and make sure that your transplants are able to quickly take up all the water you apply when irrigating. Avoid overwatering, especially on cloudy days. Leeks and onions start out so small that if they are planted in a large cell their roots can't access all the water and the soil stays wet and algae begins to grow. Leeks and onions don't need big cells—you can use as small as 288-celled trays!—and they should transplant up well since they have big root systems. You can also achieve faster drying of soil by using lighter media and/or mixing in extra perlite to improve drainage.

Improving mechanical in-row weed control for vegetable and row crops

Project Leader: Bryan Brown, PhD, Integrated Weed Management Specialist, NYSIPM, Cornell University

Co-leaders: John Wallace, PhD, Assistant Professor, Pennsylvania State University and Elizabeth Maloney, Field Technician, Cornell University

Abstract: In the crop row, it can be challenging to control weeds mechanically without damaging the crop. Based on the encouraging results of previous research using "stacked" combinations of in-row cultivation implements, we attempted to refine the use of these tools by testing several setups and adjustments. In snap beans, several implement combinations controlled over 90% of the weeds with very little crop damage. In 2-leaf beets, crop damage was unacceptably high, even when using standard implements such the spring tine harrow. But in 4-leaf beets, damage was greatly reduced and satisfactory weed control was obtained with a setup of sweeps followed by finger weeders followed by disk hillers. These setups and adjustments may be used as a starting point for growers investing in this equipment.

Figure 1. Sweeps were the first implement in the stacked sequence.

Background and Justification: Mechanical weed control is an important part of an integrated weed management approach for vegetable and field crop operations. While between-row cultivation is typically very effective, it is challenging for growers to control in-row weeds without damaging their crop. In this project, we looked to build on previous research that found by "stacking" several different cultivation implements together in a synergistic way, it is possible to dramatically increase the percentage of weeds that are killed (Brown and Gallandt 2018). Specifically, the most effective combination of implements involved first undercutting, then uprooting, and finally burying the weeds. However, crop damage remained a concern from previous trials. Therefore, in this project we aimed to adjust or replace the implements which I believed to be causing the crop damage in previous trials.

Figure 2. A row harrow (foreground) and finger weeders (background).

Objectives: Refine the setup and adjustment of "stacked" cultivation so that high efficacy is maintained but with minimal crop damage.

Procedures: Experimental design. In this project, we conducted several field trials comparing several "stacked" cultivation setups to standard sweeps and harrows. The first trail was conducted in snap beans (Phaseolus vulgaris cv Provider) planted on 30" rows with 1.6" in-row spacing on June 14, 2018. The second trial was in beets (Beta vulgaris cv Ruby Queen) planted at 10 pounds per acre on 30" rows. Half of the beet plots were cultivated at the 2-leaf stage and the other half where cultivated at the 4-leaf stage. In both trials, planting and cultivation were conducted using GPS guidance and each treatment was replicated four times. Weeds in the 4" in-row zone were counted several days after cultivation and compared to uncultivated controls to calculate efficacy.

Figure 3. A small disk hiller with guide wheels.

Rationale for implement setup. The implement responsible for undercutting weeds in previous trials of Brown and Gallandt (2018) was a torsion weeder, but super-slow-motion video analysis revealed that this tool was very aggressive on the crop, despite its spring-steel design. Therefore, we replaced this implement with shallow sweeps, which operated farther from the crop but undercut weeds and loosened soil in a similar manner to the torsion weeders (Figure 1). The finger weeder remained as the implement responsible for uprooting weeds but the fingers were widened to allow more space for the crop to pass through. A row harrow was the final implement in the

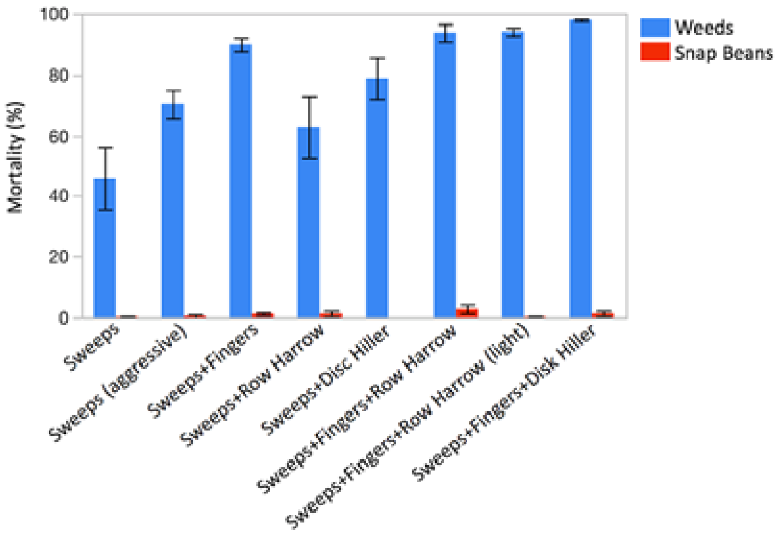
Table 1. *Treatments and implement adjustments for each cultivation trial. All treatments were conducted at 2.5 mph, except spring tine harrowing, which was conducted at 7 mph. All implements were adjusted to operate about 0.5" deep.*

Trial conditions	Treatment	Adjustment
Snap beans (1st trifoliate, 4” tall). Weeds mostly broadleaf, 1” tall	Sweeps	8.5” in-row space. This adjustment was used for the “stacked” treatments.
	Sweeps (aggressive)	6.9” in-row space.
	Sweeps+Fingers	Finger tips 1” apart when not in use.
	Sweeps+Row Harrow	Drop weight on heaviest setting.
	Sweeps+Disk Hiller	Disks 7.8” apart in front, 4.7” apart in rear.
	Sweeps+Fingers+Row Harrow	Finger tips 1” apart when not in use. Row harrow on heaviest setting.
	Sweeps+Fingers+Row Harrow (light)	Finger tips 2” apart when not in use. Row harrow on lightest setting.
	Sweeps+Fingers+Disk Hiller	Finger tips 1” apart when not in use. Disks 7.8” apart in front, 4.7” apart in rear.
Beets (2-leaf, 1.5” tall). Weeds mostly broadleaf, 0.5” tall.	Spring tine harrow	Tine angle at middle setting.
	Sweeps	7.5” in-row space.
	Sweeps+Fingers	Finger tips nearly touching when not in use.
	Sweeps+Row Harrow	Drop weight on lightest setting.
	Sweeps+Disk Hiller	Disks 7.8” apart in front, 4.7” apart in rear.
	Sweeps+Fingers+Row Harrow	Finger tips 2.4” apart when not in use. Drop weight on lightest setting.
	Sweeps+Fingers+Disk Hiller	Finger tips 2.4” apart when not in use. Disks 7.8” apart in front, 4.7” apart in rear.
Beets (4-leaf, 3” tall). Weeds mostly broadleaf, 1.5” tall	Spring tine harrow	Same as above trial.
	Sweeps	–
	Sweeps+Fingers	–
	Sweeps+Row Harrow	–
	Sweeps+Disk Hiller	–
	Sweeps+Fingers+Row Harrow	–
	Sweeps+Fingers+Disk Hiller	–

previous trials, but video revealed it was primarily burying weeds, so we sought other ways to achieve burial without having tines contact the crop. Specifically, we removed the five center tines from the row harrow and re-arranged the outer tines to pull soil into the crop row (Figure 2). We also tested a small disk hiller (Figure 3). Several one-, two-, and three-tool setups were tested (Table 1). All tools were obtained from KULT Kress and mounted on their 2-row Argus system with rear steering.

Results and Discussion: In snap beans, weed control efficacy was very high relative to crop damage (Figure 4), reflecting the dry conditions that allowed the crop to emerge with almost no weed pressure until several weeks after planting. While sweeps alone threw some soil into the row to bury 50-70% of the weeds, the “stacked” combinations had the greatest efficacy. In particular, the combinations of three implements all killed over 90% of the weeds. The “light” adjustment of the sweeps+fingers+row harrow appeared to reduce crop damage while retaining high weed control.

In 2-leaf-stage beets, crop mortality from cultivation was unacceptably high (Figure 5A). But damage was greatly reduced when beets were in the 4-leaf stage (Figure 5B). Unexpectedly, weed control efficacy remained high despite larger



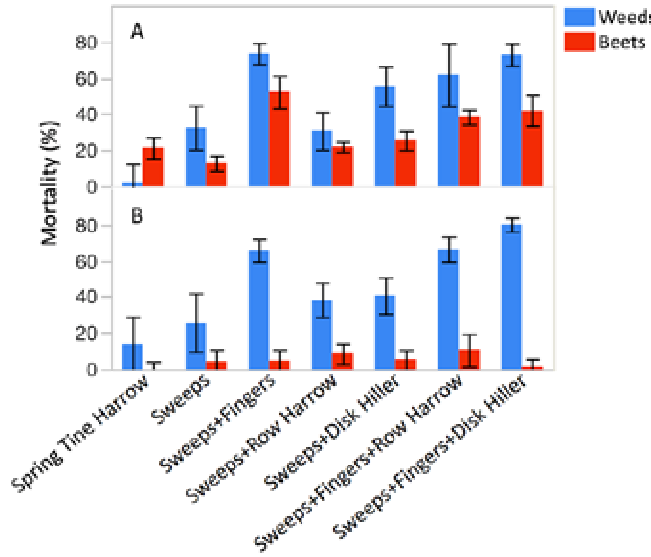


Figure 5. Mortality of weeds and beets resulting from different implement combinations and adjustments. Cultivations occurred in either 2-leaf (A) or 4-leaf (B) beets.

Figure 4. Mortality of weeds and snap beans resulting from different implement combinations and adjustments.

weeds present when beets were in the 4-leaf stage. This may relate to drier conditions during the latter cultivation. Most of the "stacked" combinations killed a greater percentage of the weeds than the spring tine harrow. The sweeps+finger+disk hiller combination performed very well in this trial.

Overall, the cultivation setups in these trials provide a relatively low-tech solution for farmers to improve their in-row weed control. These extra implements can be "stacked" onto farmers' existing equipment at a reasonable cost.

Literature Cited: Brown B, Gallandt ER (2018). Evidence of synergy with 'stacked' intrarow cultivation tools. Weed Research. doi.org/10.1111/wre.12309.

Video: Brown, B. Stacked cultivation trials, 2018. NYSIPM. Available at https://youtu.be/jdzv6x8QI2A

This work is supported by the Crop Protection and Pest Management Extension Implementation Program [grant no. 2017-70006-27142/project accession no. 1014000] from the USDA National Institute of Food and Agriculture.

Elliot Farm Offers a Solution to Bird Crop Damage with Laser Scarecrows

Ken and Deanna Elliot, siblings and co-owners of Elliot Farm in Lakeville, MA. Photo: C. Delaney, Northeast SARE

In 2018, Ken and Deanna Elliot received a Northeast SARE Farmer Grant to design, build, and test their own laser scarecrows for bird control. In their final SARE Grant report, they wrote: "After piloting 9 units during the 2018 farm season, Elliot Farm reported a reduction in bird damage, recording a 20% damage rate in the height of bird season, down from the historical 80% damage rate. The farmers also found that if the lasers were used in conjunction with a bird distress call, the damage was further mitigated to just 8%. The preemptive installation of the technology was vital to crop protection success. The laser scarecrows and bird distress calls had to be up and running prior to the corn ripening to deter the birds from ever entering the field."

On March 20th, 2019, Katelyn Parsons at the Massachusetts Farm Bureau Federation (MFBF) hosted a webinar about Northeast SARE Grants for farmers. Speakers were: Katie Campbell-Nelson, SARE Massachusetts State Coordinator and UMass Extension Vegetable Program Educator, and Ken Elliot, of Elliot Farm, who spoke about his experience working with Northeast SARE on his *farmer grant (FNE18-893 Laser Scarecrow Prototype). Here are Ken's words transcribed from that webinar:*

"I run a 50 acre family farm in Lakeville MA with my sister, and I would say 40 acres of that are sweetcorn. Historically, the largest pest problem we've had are redwing blackbirds and European starlings in the corn. They last for only about 5 weeks out of the 12-15 week corn season when we are picking. But in those 5 weeks, they destroy roughly 80% of the corn grown. Financially this is a huge hit, and every corn grower I know is going through the same thing. I've talked to people in other parts of the country and the same birds are decimating sunflower crops and sweetcorn all over the place.

We have tried the commercially available bird control options (including balloons, bird distress calls, bird repellent, reflecting tape, and netting) in the past and had terrible luck. We could only get rid of the birds for a couple of days at best. We had heard good things about lasers, but stand-alone ones that are commercially available currently cost anywhere between $3,000-$10,000 per unit. On a farm like mine, I have 15 different fields that are not adjoining. To cover all the corn I would need to protect at any given moment, it would be financially ridiculous to buy enough lasers to do the job.

I heard about a laser scarecrow project that Dr. Rebecca Brown at the University of Rhode Island was doing in 2017, and I decided to test out their laser. It worked fantastically, but that laser broke, probably 6 times in a 5-week period. So, a laser that doesn't work 30% of the time isn't any good either. That's what inspired me to design my own laser that would hopefully be both cheap and indestructible.

The Elliot Farm laser scarecrow prototype.
photo: C. Delaney, Northeast SARE

Once we figured out what we wanted to build, that's when we decided to write a grant for it. We went out and found two technical advisors; one from UMass who was an agricultural pest specialist (Sue Scheufele) and another from the Wentworth School of Technology, Steve Chomyszak (Assistant Professor in the Department of Mechanical Engineering & Technology). Steve from Wentworth helped me figure out exactly what the cost was going to be prior to submitting the grant so that we could estimate the costs of everything. Then we applied, and once we received the grant I was going up once or twice a month to Wentworth School of Technology where I met with Steve and four student interns who were all paid by SARE to help design this prototype and build it.

I really wanted this laser to work, not just for us, but for other farmers to be able to go out and build these things themselves. We designed it to be as simple to build as possible, and designed it so you could build it using all commercially available parts. You can go on the internet and buy absolutely every single part. We repurposed some parts. For example, we have one part that you can bend so that you can aim the laser, and I believe that specific part is generally used in a machine shop to direct oil onto a surface where they are cutting metal. Anyone can go out, get these parts, and put this thing together. From a layperson's perspective who doesn't understand how the laser works—because I'm a person who doesn't understand how it works—that's OK. As long as you follow the directions, in 3-4 hours you can build this laser for less than $500. Parts lists and instructions can be found on our website.

Once we had the prototypes built, I tested 9 units on my own farm, and I didn't have the results I hoped for (which was only 1% damage). I still had about 20% damage in the corn. It wasn't fail proof, but 20% damage is a far cry from 80% damage, so we were really pretty proud with what we came up with."

Note on managing the SARE grant budget:

"I would say to anyone who is applying for SARE grants that although you will budget out at the beginning for how much everything costs, things are going to change, things are going to go wrong, and you'll to have to touch base with SARE again to adjust that budget, move money around. You won't get more money but just let them know when the costs change. Keep track of everything. After getting 9 laser prototypes built, I tracked all the damage estimates throughout the season, and then we wrote a report, published our research and made a website with the plans to build the laser. Once we had done the work, we applied for reimbursement from SARE."

Katelyn Parsons (MFBF): Would you recommend these grants to other farmers?

Ken Elliot: Oh, absolutely, it was a wonderful experience. It helped us out by reducing bird damage which usually I would average that we lost about $20,000 worth of corn, and we reduced that to maybe $3,000-$4,000 so that's a huge financial benefit. It's wonderful that we could publish this so that other people can go out, build these things, and do the same thing. I know a lot of folks who grow sweet corn, and they're all at their wits ends, just about ready to quit if something doesn't break.

Katelyn Parsons: Can you talk about technical advisors for SARE grants? How would you recommend farmers go about finding those?

Ken Elliot: What we did for technical advisors was, we found schools we knew had either a strong agricultural department or strong engineering department, and scoured their websites for contact information for folks in those departments and blindly reached out to them. We very quickly received responses from them saying that they were eager to help us. I think, at least in my experience, if you make the effort and reach out, people in these particular careers seem more than eager to give you a hand.

--Transcribed by Katie Campbell-Nelson from Ken Elliot; Grant report text from Deanna Elliot
Funded by Northeast SARE

Resources:

Build your own laser scarecrow by Ken and Deanna Elliot, accessed 3/23/2019

"Laser Scarecrow Prototype" 2018 SARE Farmer Grant Report (FNE18-893) by Ken and Deanna Elliot, accessed 3/28/2019

'Testing laser scarecrows for neighbor-friendly bird damage reduction in sweet corn on periurban farms' SARE Partnership Grant Report (ONE17-291) by Rebecca Brown, accessed 3/28/2019

Pest Scouting and Using the UMass Scouting Sheets

What is scouting and why is it useful? Scouting is the process of routinely checking crops for pests and disease to inform management decisions. The way to do this is to regularly check a random sample of plants across a field to get a sense of what pests are present and in what quantities, how widespread the problem is, and to identify any patterns in distribution, so that you can decide whether or not it's time to implement a control strategy. It's often a good idea to get into the field and see for yourself what's happening when a pest has been detected on or near your farm, or when monitoring data or environmental conditions indicate that a particular pest may be emerging. Successfully implementing IPM requires that you are aware of the conditions on and around your farm each year and over time. Furthermore, establishing a scouting program can help you keep track of what you see and allow you to detect pest problems early and prevent and manage issues before they cause economic losses. Regular scouting will also help you determine whether your spray program and other control strategies are effective, as you can see pest numbers going up or down over time. The UMass Vegetable Program has developed a series of crop-specific scouting sheets, linked o on the next page, to help you keep track of your scouting and make decisions about what you find!

Some things to consider before you go into the field:

Field history. What crop or crop family was planted here last year and what pest issues were there? Consider insect pests, but also diseases that might persist in soil or on crop residues, and weeds. Also note locations of field edges, as pests may emerge from windrows, woods, or adjacent fields. Note shaded areas or places with poor drainage.

Pest identification. Know what you're looking for! It's important to be able to identify some of the key insects that may be feeding on your crop and to be able to tell the good bugs from the bad. You should also be able to recognize some of the signs and symptoms of insect feeding, and common diseases and physiological disorders. There are lots of great ID guides out there, including the Northeast Vegetable & Strawberry Pest Identification Guide—a collaborative effort of the New England Extensions. It can be very tricky to identify problems in the field, though, so if you find something suspect, consider having it diagnosed at the UMass Plant Diagnostic Lab, or testing soil or plant tissues for nutrients at the UMass Soil and Plant Tissue Testing Lab.

Pest life cycles. Consider when certain pests are active and if they overwinter or persist in the environment, or if they have to travel from warmer locations on storm fronts. Pheromone traps, sticky cards, keeping track of growing degree days (GDDs), and using web-based monitoring tools can all help with knowing when to keep an eye out for particular insects and/or diseases. It's also important to know what the different life stages of insect pests look like, where you might find them, and which stage(s) will harm your crop.

Economic threshold and economic injury level (Fig. 1). The economic threshold is the pest population size or the level of damage that a crop can tolerate without economic impact. When the threshold is reached, some control should be implemented. The economic injury level is that point above which crop yield will be effected by pest damage, and the benefit of controlling the pest outweighs the cost. Often, thresholds have been established through scientific research. You may develop your own thresholds based on your scouting records and trends on your own farm, as well as what your markets may tolerate. Shareholders of a CSA may be more tolerant of some insect feeding than a high-end restaurant, for instance.

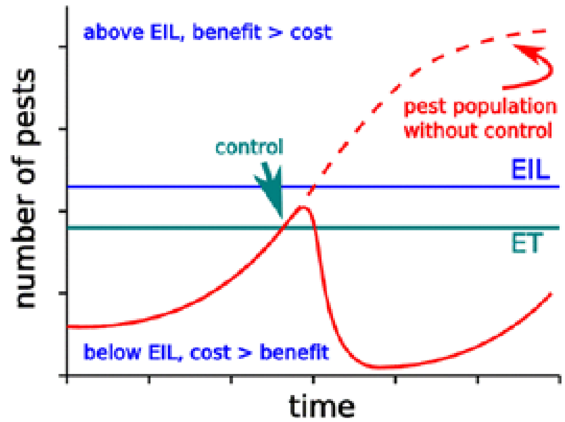


Figure 1. Relationship between economic threshold (ET) and the economic injury level (EIL)

Management options. What pesticide options and other control strategies do you have available and how effective are they? Your economic threshold may be lower than those published if you are using organic materials, since economic thresholds are designed with conventional pesticides in mind and many organic materials are less effective than conventional materials. Or you may not have an effective control option for a current pest problem, but scouting and keeping records will help you prevent problems in the future by using crop rotations, row covers, or materials applied at-planting. Have some sense of what you will do with the information you collect.

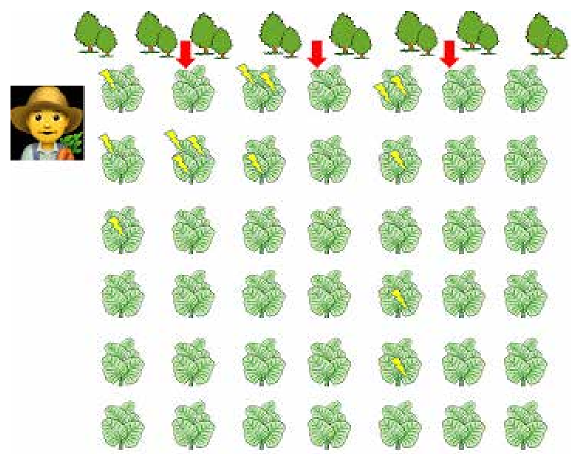


Figure 2. A farmer sees heavy pest pressure on the edge of a field near the tree line. Image: S. Scheufele

Now to scouting! The idea here is to assess a random sample of plants that is representative of what is happening in the whole field or crop, or to identify hot spots or problem areas in the field or among different crops or varieties. Don't make spray decisions based on what you see on the first couple of plants in your sampling! You might panic because the first plant is covered in beetles, but then realize that the problem is localized and that the crop as a whole is well below threshold (Figs. 2 and 3).

First, take a look at the field as a whole and note if anything looks abnormal. Then, decide how you will divide the field into units. If you plan to look at 25 plants, decide about how frequently you would have to stop to get a sampling of the entire field.

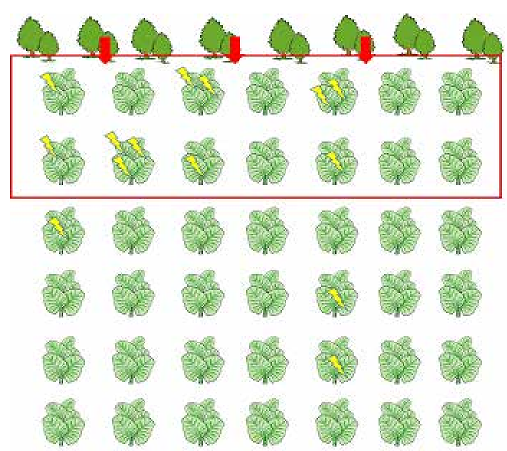


Figure 3. After surveying the whole field, the farmer finds that only the plants near the treeline have heavy pest pressure, while the whole field is under threshold and no treatment is necessary. Image: S. Scheufele

We have scouting sheets for the following crops:

Allium	Eggplant	Strawberry
Brassica	Pepper	Sweet corn
Cucurbit	Potato	Tomato

Each sheet has a list of common pests, thresholds if available, along with some sampling instructions. Thresholds or control options may vary depending on the stage of the crop, so there is a place to note that as well. For example, in potato you should scout 3 plants per site when the crop is small or 3 individual stalks once the plants are hilled. Note the unit you are using and what the threshold is.

Using the appropriate scouting sheet for the crop you are inspecting, move through the field, stopping at random spots—moving in a V or W pattern works best—and look at whatever plant(s) happen to be wherever you stop. It helps to count about the same number of paces between samples, so that you avoid getting a biased sample by inadvertently stopping at plants that are obviously affected or infested. Look at and around the plant, then inspect more closely—pests and symptoms can often be found on the undersides of leaves or on stems. It's good to have a hand lens with you for looking at small insects or mysterious lesions. Record what you see in the appropriate line on the scouting sheet, along with any notes you think are important. There is a spot on the sheets labeled 'scouting map' so you can record your path. This may reveal that there is higher pressure on one area of the field, which can indicate where a pest is entering, or a preference for a certain variety.

When you have finished sampling, count your results. Take the average for whatever unit you are considering for your threshold—it may be insects per leaf, or damage per plant—and compare that number to your threshold. If you are above threshold, apply your control strategy. If you are below, wait to treat and scout again at some regular interval (e.g. the following week). If you implement a control, scout again afterward to determine if the treatment worked and when/if you should make another application. If you found natural enemies when scouting, consider them when deciding which material to use or whether a pesticide application is warranted.

Using these scouting sheets throughout the season and over multiple years can help you to identify trends and understand your pest levels and cycles and the effectiveness of your management strategies over time. If you do use the UMass scouting sheets, we'd love your feedback! Let us know if they help you manage your scouting program, and if you have suggestions for how they can be improved. Contact us at 413-577-3976 or umassvegetable@umext.umass.edu.

We also have more detailed scouting guides for sweet corn and cucurbits:

Sweet Corn IPM Guide

Cucurbit Disease Scouting and Management Guide

--Written by Lisa McKeag, UMass Vegetable Program

Events

Brassica Pest Collaborative: Managing Insect Pests of Brassicas – Online Workshop Series

Join the Brassica Pest Collaborative's series of online workshops on managing insect pests of brassicas! Each online workshop will be ~30 minutes of presentation with 15-30 minutes for your questions. Please feel free to send in questions ahead of time by email (sscheufele@umass.edu), or post questions during the seminar via chat-box.

When: All workshops will be held Fridays from 12-1pm. Please allow a few minutes before noon to download the program, sign-in, and get acquainted with the program. See dates in the schedule below.

How to join: Register for each online workshop with the links in the schedule below. You will receive a link via email to join the workshop when the time comes. You can join by computer to see the live-streaming presentation and Q&A, or join by phone to just listen in.

This material is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, through the Northeast Sustainable Agriculture Research and Education program under subaward number LNE18-365

- **TOMORROW!** Caterpillars 2: Imported Cabbageworm & Cross-Striped Cabbageworm

  When: Friday, March 29, 2019, 12noon to 1pm
  Presenter: Ana Legrand, UConn Extension
  Registration: Click here to register.

- Cabbage Maggot Biology, Management & Research Update

  When: Friday, April 5, 2019, 12noon to 1pm
  Presenter: Faruque Zaman, Cornell Cooperative Extension-Suffolk County
  Registration: Click here to register.

- Flea Beetle Biology, Management & Research Update

  When: Friday, April 12, 2019, 12noon to 1pm
  Presenters: Dan Gilrein and Faruque Zaman, Cornell Cooperative Extension-Suffolk County
  Registration: Click here to register.

Worker Protection Standard Train-the-Trainer

The UMass Pesticide Education office has scheduled four WPS Train-the-Trainer workshops in April and May. United States Department of Agriculture cooperating. UMass Extension provides equal opportunity in programs and employment. All farmworkers must be trained under the EPA Worker Protection Standard (WPS) if a farm uses any pesticides, including, those approved for organic production and other general use pesticides. The agricultural worker employer is responsible for complying with all components of WPS including the training of farmworkers. This training can only be provided by an individual who has a pesticide certification license or has attended an approved EPA WPS Train-the-Trainer workshop.

- **UMass, Amherst, MA**

  When: Wednesday, April 17, 8am-12:30pm

  Where: French Hall, 230 Stockbridge Rd., UMass, Amherst, MA

- **Marlborough, MA**

  When: Monday, April 22, 8am-12:30pm

  Where: Best Western, 181 Boston Post Road West (Route 20), Marlborough, MA

- **Topsfield, MA**

  When: Tuesday, April 23, 8am-12:30pm

  Where: Bee Building, Topsfield Fairgrounds, 207 Boston St., Topsfield, MA

- **East Wareham, MA**

  When: Thursday, May 2, 8am-12:30pm

  Where: UMass Cranberry Station, 1 State Bog Rd., East Wareham, MA

REGISTRATION: $40/person. Pre-registration required. For registration information, visit the UMass Pesticide Education website.

Sponsored by the UMass Extension Risk Management Crop Insurance Education Program.

Creating Pollinator Forage in the Landscape

Tom Sullivan of Pollinators Welcome will present strategies for improving bee forage. He will cover bee-friendly flowers, bloom phenology, and how to choose plants that meet site conditions and increase pollinator diversity and abundance. Along the way, he will identify threats to pollinator health and explain how we can help bees by creating pollinator havens on farms, in gardens, and within conservation areas. He will also cover native bee biology and nesting needs, and explore the basics of meadow making for beekeepers and other pollinator-positive stewards. We will go outside if weather permits, and ample resources will be provided via email after the workshop. Coffee and light refreshments will be provided.

When: Sunday, June 2, 8:30am-12:30pm

Where: Agricultural Learning Center, UMass Amherst

Registration: $25. Pay with cash or check at the door. Click here to register for this event.

This workshop is partially supported by a grant from the USDA.

Thank you to our sponsors:

Sponsor *Veg Notes*

Vegetable Notes. Katie Campbell-Nelson, Genevieve Higgins, Lisa McKeag, Susan Scheufele, co-editors.

Where trade names or commercial products are used, no company or product endorsement is implied or intended. Always read the label before using any pesticide. The label is the legal document for product use. Disregard any information in this newsletter if it is in conflict with the label.

The University of Massachusetts Extension is an equal opportunity provider and employer, United States Department of Agriculture cooperating. Contact your local Extension office for information on disability accommodations. Contact the State Center Directors Office if you have concerns related to discrimination, 413-545-4800.