UMass Extension
# Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

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## In this issue:



## Crop conditions

Potatoes are up and the first warm season crops are in the ground on plastic (tomatoes, eggplant, cucurbits). Other transplants are hardening off outside of greenhouses, eager to get in the ground. While row cover is coming off some crops, like head lettuce ready for harvest, new transplants of brassicas are getting covered for protection against flea beetles which are emerging now across the state. Sweet corn is pushing up under clear plastic for those getting an early start, and we are putting out our European corn borer traps this week to capture the first flight. Asparagus is coming into peak season after some growers in Rhode Island, New Hampshire and Massachusetts reported frost damage on the first spears emerging in April. Healthy stands of over wintered vetch and rye were plowed under in the last few weeks and decomposition has picked up as soil temperatures rose and fields are disked and seed beds prepped.

*Farmer Don Zasada of Caretaker Farm in Williamstown, MA inspecting the nitrogen fixing nodules on his vetch cover crop at a apprentice farmer meeting last week.*

## Pest alerts

**Allium Leaf Miner:** is a new invasive pest that was confirmed in New Jersey this month and was reported in Pennsylvania in December of 2015. These are the only reports of this pest, which is native to Poland, in the Western Hemisphere—it has not been reported in New England. Suspected infestations should be reported to the UMass Plant Diagnostic Lab: ammadeir@umass.edu, 413-545-3209. Females lay eggs in a linear pattern towards the tip of leaves (Figure 1). After larvae hatch, they mine their way down towards bulbs causing leaves to become wavy, curled and distorted (Figure 2). Where the pest is present, adult fly activity should decline after 2-3 weeks, according to available information on this pest. After this point, larvae will pupate (Figure 3) and remain dormant for much of the summer. Flies will emerge in late-summer and early-fall and may infest the fall crop.

**Brassica:** Cabbage root maggots were found in a mixed brassica planting in Hampshire Co., MA, last week, where eggs had been laid in the seedling trays and hatched once transplanted in the field. Make sure to scout transplant trays for eggs before setting them out and treat if 1 egg per plant

*Fig. 1. Oviposition scars on onion leaves. Photo: Sabrina Tirpak.*

*Fig. 2 Allium leafminer pupa within leaf tissue. Photo: L. Donovall.*

*Fig. 3 Allium leafminer damage. Photo: L. Donovall.*

is found. Pre-plant and transplant treatments are listed in the New England Vegetable Management Guide. Adult emergence and flight may be monitored by following the NEWA cabbage maggot forecasting model or by using yellow sticky cards. Most locations in MA have exceeded 75% emergence at 547 GDD base 40°F (Table 1) and maggot activity is likely widespread.

The first **flea beetles** are being observed across MA, and pressure is likely to increase in the next few weeks. There is no fixed economic threshold that applies to all crops, but crops with more waxy leaves (e.g. cabbage, broccoli, kale) are less attractive than crops with glossy leaves (e.g. bok choy, Napa cabbage, mustard). As a general guideline, treat at an average of 1 flea beetle per plant or when damage exceeds 10% of leaf area affected. See article this issue for more information.

**Beet, Swiss Chard, and Spinach:** **Leaf miner** eggs were found outdoors in a spinach crop in Franklin Co., MA this week. Treat when eggs are first observed, as they will hatch in 3-6 days and once they are inside the leaf, they can no longer be effectively reached with contact insecticides, but translaminar and systemic materials may be effective.

**Multiple:** **Seed corn maggot** caused 100% loss of a high tunnel cucurbit crop in Hampshire Co., MA. A second round of cucumbers planted into the same tunnel were also all killed last week. Eric Sideman of Maine Organic Farming Association noted: "If you need to replant, wait at least 5 days if maggots that you find are a quarter inch long; if they are smaller than that, wait at least 10 days to make sure they have pupated and will not damage the new seeds." This pest was also confirmed by the UMass plant diagnostic lab in cucumbers transplanted into black plastic from Hartford Co., CT, and a grower from Burlington, VT reported: "The faux warmup in early April led to our worst seed corn maggot problem in years: our entire planting of snap peas was wiped out." Since peak flight (50% emergence) of this pest occurs at 360 GDD, we have mostly passed the infestation period in MA (Table 1). Larvae feed on seeds and young seedlings of many crops (e.g. corn, beans, beets, peas, spinach, onions, cole crops).

**Asiatic beetle grubs** were plentiful in a field recently in weedy pasture in Providence Co., RI. These grubs are attracted to broadleaf plants and vegetable seedlings. They can be a pest. *Heterorhabditis bacteriophora* and *Stienernema glaseri* nematodes efficacy is variable and most effectively applied in late-August to early-September when the grubs are in their early instars and moving down into the soil. Applications of beneficial nematodes made now in the field can be very expensive and likely not very effective. Thresholds have only been established for turf grass where 10 to 15 grubs/ft$^2$ can be present before control is warranted.

**Yellow-lined cutworm** has been reported hitting asparagus, brassicas and onions for the last few weeks in CT. Last year it was also reported in asparagus and peppers – the damage looked like that of pepper weevil with nice round holes in the leaves and fruit. As with any cutworm, a synthetic pyrethroid application at night will take them out. For organic growers, Seduce (spinosad bait) is registered for cutworm control.

Table 1. Accumulated Growing Degree Days (Base 40F): 1/1/16 - 5/19/16

| Location | GDD |
|---|---|
| Western, MA | |
| Ashfield | 499.5 |
| South Deerfield | 597.5 |
| Pittsfield | 497.7 |
| Central, MA | |
| Bolton | 618.4 |
| Northbridge | 640.8 |
| Phillipston | 487.7 |
| Eastern, MA | |
| Ipswich | 576.9 |
| Weston | 688.8 |
| Seekonk | 781 |
| Hollis, NH | 556.5 |
| Burlington, VT | 465.7 |

*Leaf miner eggs on spinach. Photo: A.Radin, URI*

*Yellow-lined cutworm. Photo: S. Mitchell, CT*

**Cold Temperature:** Frost damage is being reported on sensitive crops across New England. Tomato and pepper seedlings in unheated tunnels were damaged in southern ME. Temperatures below 45°F can damage the first fruit set even before flowers have set so keep an eye out for the first emerging fruit and thin them out if they look deformed. Total loss of an early season cucumber and melon crop was reported last week—it was transplanted too early (back in April) and succumbed to frost even under cover. Asparagus growers report frost damage in the earliest spears. Stems are shrunken and hollow or tips are shriveled. Only in the last few days have healthy spears appeared in these fields.

Table 1. Salt tolerance of vegetable crops. Electrical conductivity observed at 50% yield reduction (Adapted from Ayers and Westcot, 1976)

| Crop | EC (mmhos/cm) |
|---|---|
| Strawberry | 2.5 |
| Bean | 3.7 |
| Onion | 4.3 |
| Carrot | 4.6 |
| Pepper | 5.1 |
| Radish | 5.1 |
| Lettuce | 5.2 |
| Corn, sweet | 5.9 |
| Potato | 5.9 |
| Sweet Potato | 6 |
| Cucumber | 6.4 |
| Turnip | 6.5 |
| Cabbage | 7 |
| Tomato | 7.5 |
| Broccoli | 8.3 |
| Spinach | 8.6 |
| Beet | 9.6 |
| Celery | 9.9 |
| Zucchini | 10 |

Table 2. Salt indexes for common fertilizers (Adapted from: Fertilizer Salt Index, 2002)

| Fertilizer | Salt Index |
|---|---|
| Manure Salts | 113 |
| Ammonium nitrate | 104 |
| Ammonium sulfate | 88 |
| Urea | 74 |
| Ammonium polyphosphate | 20 |
| Monoammonium phosphate | 27 |
| Diammonium phosphate | 29 |
| Potassium chloride | 116 |
| Potassium nitrate | 69 |
| Potassium sulfate | 43 |
| Ammonium thiosulfate | 90 |

## IMPROVING IRRIGATION TO MANAGE SALT BUILD UP IN HIGH TUNNELS

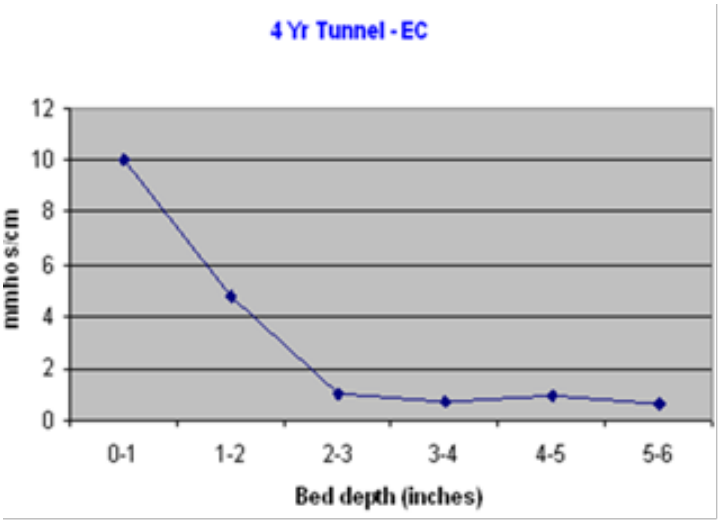
Growers in MA have now been using high tunnels for several years, adding organic amendments like compost yearly, and in cases where the plastic is left on the tunnel year round, salt build-up can become a problem. Germinating seeds and young seedlings are most susceptible to salt damage. In established crops, high salt concentrations make it difficult for crops to take up water from the soil, therefore reducing yields. In response to several salinity questions from growers about high tunnels this spring, I have installed a few moisture sensors at various locations and begun taking electrical conductivity (EC) readings of the soil to monitor what is happening.

Maintaining soil moisture at field capacity (50% of air pore space filled) is important in high tunnel production because of potential for salt injury or other nutrient related disorders such as blossom end rot or yellow shoulder in tomatoes which can occur with large fluctuations in soil moisture content. Soluble salts are dissolved ions from soil, organic matter, and fertilizers which are measured with an electrical conductivity (EC) meter, and for most tunnel crops, the soil should read 2-4 mmhos/cm. Salt tolerance of vegetable crops can vary widely (Table 1). Salt buildup can be prevented by avoiding excessive applications of organic materials like compost, by diligently managing soluble fertilizers, by avoiding fertilizers with a high salt index (Table 2), and those high in ammonium forms of nitrogen, and by maintaining soil at water holding capacity.

Often, amendments are not incorporated deeply enough into high tunnel soils and even incorporated salts (which mainly consist of valuable plant nutrients!) are easily wicked to the soil surface by irrigation water. Bruce Hoskins, University of Maine Soil Analytical Lab Director analyzed soil from a high tunnel in production for 4 years and found that salts are heavily concentrated in the top 0-2 inches (Fig. 1a and b). High salt accumulation in the top inches of tunnel soils could be the reason why even highly salt tolerant crops like spinach can get salt injury in a tunnel because they are shallow rooted. In this case, soil tests taken to a depth of 6" would not indicate unusually high soluble salt levels. Monitoring EC and soil moisture on your own is easy to do with relatively inexpensive equipment.

**Monitoring EC:** If your soluble salts were tested by a soil lab in a saturated media extract test (SME), then, the EC will be in the ranges reported in Table 1 above. If you are measuring soluble salts in your own high tunnel soils, the 1:2 dilution method has been used for many years and has good interpretative data to back it up, however, the results must be converted to saturated media extract (SME) levels in order to interpret results (Table 3). In the 1:2 method, an air-dried sample of soil and water are mixed together in the volume ratio of 1 part soil to 2 parts water (e.g., using a measuring cup, 3 fl. oz. of soil + 6 fl. oz. of water). The liquid extract is then separated from the solids using laboratory grade filter paper or 2 common coffee filters doubled up. The extract is then ready for analysis. This is a very easy test to master and quite suitable for on-site greenhouse testing of pH and soluble salt using the so-called pH and EC "pens" available from greenhouse suppliers. In the reference section below, there is a great video demonstrating how to take this test made by Tina Smith and Doug Cox of the UMass Greenhouse and Floriculture Program. **Portable EC meters:** KBW Supply, Hannah Instruments

**Monitoring Soil Moisture:** To maintain soil moisture at field capacity, two tensiometers or soil moisture sensors may be



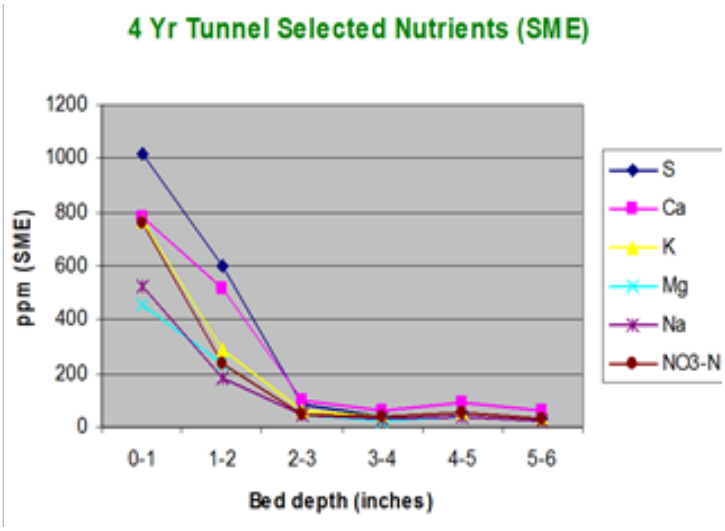




*Figure 1a. (left) Electrical conductivity of a 4year old high tunnel at different depths after crop harvest. 1b (right). Saturated Media Extracted nutrients in the same high tunnel at different depths after crop harvest. Images courtesy of Bruce Hoskins, UMaine Soil*

Table 3. Soluble salts levels determined by different methods of media analysis.

| 1:2 | SME | Indication |
|---|---|---|
| 0-0.03 | 0-0.8 | Very low |
| 0.3-0.8 | 0.8-2.0 | Low |
| 0.8-1.3 | 2.0-3.5 | Normal |
| 1.3-1.8 | 3.5-5.0 | High |
| 1.8-2.3 | 5.0-6.0 | Very high |
| >2.3 | >6.0 | Extreme |

*Installing a moisture sensor in a high tunnel tomato crop. Photo: K. Campbell-Nelson*


*Video: "1:2 method of Soil Testing for Greenhouse Crops":* https://youtu.be/int0FevLw8I

installed at 6" and at the rooting depth of the crop (12" for pepper, 18-24" for tomato, cucumber and eggplant). Depending on the soil texture in your tunnel (Table 3), irrigate when your tensiometer or moisture sensor is at 25% depletion and bring the soil moisture level up to field capacity for your soil type. Tunnels heavily amended with compost will have a higher water holding capacity than field soils, so, decrease the rate of depletion accordingly. Follow the instructions on page 46 of the "Iowa High Tunnel Fruit and Vegetable Production Guide" linked below to calculate gallons of water needed to bring your volume of soil to the rooting depth of your crop up to field capacity. **Soil Moisture sensors: Hansen, Spectrum Technologies, Irrometer**

**Recommendations:** Till the soil to 8" or more between plantings to make sure that salts get reincorporated deeply into the soil profile. Using moisture meters or a tensiometer, maintain soil moisture at field capacity, but not saturation (100% of soil pore spaced filled), and uncover tunnels during the off-season so that the soils may be well flushed. An EC meter is a helpful tool for periodic measurements during the season since mineralization may occur quickly in warm, moist tunnels causing salt loads to be released from organic matter and be wicked to the surface.

Compost and other organic amendments are typically slow to mineralize, although they may mineralize more quickly in hotter temperatures found in tunnels, releasing salts more rapidly. For this reason, it is desirable to find liquid fertilizers that can provide nutrients immediately. For organic growers, Chilean nitrate (12-1-1) and Potassium sulfate (0-0-50) can be dissolved in warm water and used to fertigate. Nature Source (8-1-1) is another good option which is low in P and does not clog up fertigation systems like fish emulsion does (It doesn't smell as bad either!).

**Resources:**

"Soil Moisture Monitoring and Sensor Installation" University of Minnesota Extension http://hightunnels.cfans.umn.edu/management/irrigation/soil-moisture-monitoring/

"Iowa High Tunnel Fruit and Vegetable Production Guide" PM 2098

January 2010. Leopold Center. https://www.leopold.iastate.edu/sites/default/files/pubs-and-papers/2010-01-iowa-high-tunnel-fruit-and-vegetable-production-manual.pdf

Video: "1:2 method of Soil Testing for Greenhouse Crops", UMass Extension Greenhouse and Floriculture Program: https://youtu.be/int0FevLw8I

Cox, D. University of Massachusetts. "Current Methods of Greenhouse Media Testing and How they Differ" https://ag.umass.edu/fact-sheets/current-methods-of-greenhouse-media-testing-how-they-differ

Cox, D. University of Massachusetts. How to Use pH and EC "Pens" to Monitor Greenhouse Crop Nutrition. https://ag.umass.edu/fact-sheets/how-to-use-ph-ec-pens-to-monitor-greenhouse-crop-nutrition

*--by Katie Campbell-Nelson, UMass Extension, with thanks to Andy Radin, URI Extension and Bruce Hoskins, UMaine Soil Lab for review.*

## WHAT YOU NEED TO KNOW ABOUT USING SANITIZER MONITORING STRIPS

*-By Robert Hadad – Cornell Regional Vegetable Specialist – CCE, rgh26@cornell.edu*

*Originally published in Cornell Cooperative Extension's Veg Edge newsletter, Vol.12:5, May 4, 2016. The research described below was done by Robert Hadad at Cornell University.*

For post-harvest washing or rinsing of produce, the use of sanitizer in the water is highly recommended for food safety. Sanitizer added to water will help to reduce the microbial risk that might occur from introduction of contamination into the water. Sanitizers don't really clean produce. Instead, sanitizers keep the wash water from being contaminated with microbes and subsequently contaminating the produce that is being washed.

To make sure the sanitizers are at the correct concentration at the beginning of the wash cycle or for checking the levels during the wash process, monitor strips specific for different types of sanitizers are available. There are test strips for free available chlorine, peracetic acid (PAA), and hydrogen peroxide. Similar in method of use to pool water and pH strips, the sanitizer strips are dipped into the wash water, they turn color, and then you match the color to a chart on the label of the test strip container.

We wanted to check on the ease of use, accuracy, and consistency of various brands and ages of test strips readily found in the marketplace. The trial was done using clean tubs filled with municipal water (10 gallons). The pH was checked and it was 7.0. Three tubs were used to give us three replications. Five test strips from each brand and age were used for each tub giving a total of 15 readings. The calculation for the concentration used in produce washing for the PAA from the label was 60ppm and this was added to the water for each tub. The sanitizer was mixed thoroughly into the water and left for 10 minutes. The strips were then dipped into the water per label instructions and the color chart matches provided the ppm of sanitizer that each strip was supposed to be representing.

The results were rather disappointing. Two brands of PAA strips gave variable results. One had results that were more than half of what the ppm should have been representing. Another brand consistently gave higher readings than it should have. Two samples had strips that were expired (even though one was purchased late last fall). One of these expired samples gave mixed lower results, the other gave consistent spot-on results of 60ppm. Two other brands had results that had the majority of strips at 60ppm or just slightly higher.

The problem with color chart matching is a big issue. For most of the brands, the differences in color representing different ppm aren't very distinct. Depending on the light, the observations seemed variable. Bright sunlight vs inside a darker shed can give different views of the color chart or the color of the strip.

Another issue that became quickly apparent is that the directions for using the strips on the label may be different and in some cases very different for each. There is a quick time limit for matching the dipped strips against the color chart before the colors change – some as little as 10 seconds. Dip times in the water ranged from1 second to 2 to no mention of duration. Some wanted the strips to be moved in the water while others wanted them held still.

The chlorine strip test failed miserably. The trial was held with fresh water and rinsed out tubs. Germicidal chlorine bleach (8.25%) was added at 50ppm. The strips did not read accurately at all, with all the strips showing concentrations way low or not at all.

**Conclusions:**

- How the directions are followed have a direct bearing on the results. Be sure the directions are followed to the letter and adhere to the time for dipping and the time to read the strip against the chart.
- The age of the strips may have an effect; check expiration dates on the packages and store packages properly according to the label.
- Prior to harvest, do a run-through – set up the wash water and add the correct concentration of sanitizer. Check your math. Know how much volume of water you are using and mark it with marker on the side of the tub or basin exactly. In this way, you can fill the correct amount each time. Be precise when adding the correct concentration of sanitizer. Use the test strips and get a feel for how to take the readings quickly. If you don't get the readings you think you should have, go over all the steps again to make sure everything is correct. If the readings are still off, purchase a new set of strips and maybe a different brand.

Monitoring strips are a guide for growers to be able to check if sanitizer concentrations start at the right levels and lower after washing produce. More sanitizer can then be added or a new batch of clean water in the tubs can be set up. Keep in mind that the monitoring strips can be variable so if you know you have set up the wash water correctly with sanitizer, the strips should be giving you a pretty close reading. Once set, continued monitoring periodically during the wash cycle will provide guidance on when the sanitizer levels start to decline and need replenishing or replacement.

For lists and information on sanitizers go to:

https://ag.purdue.edu/hla/foodsafety/Pages/WashWaterSanitizers.aspx OR

https://store.extension.iastate.edu/Product/Guide-to-Liquid-Sanitizer-Washes-with-Fruit-and-Vegetables

## FLEA BEETLE MANAGEMENT

Flea beetles have emerged from their overwintering homes in the shrubby or wooded areas surrounding fields and be- gun to feed on the first spring brassica plantings. Controlling flea beetles can seem like a losing battle, but we have seen real success on farms that have taken an integrated approach to management. The most important steps to reducing the population size and damage caused by flea beetles seem to be breaking the cycle (rotating spring crops as far as possible from overwintering sites near last years' fall crop), and controlling early season outbreaks using something like a trap crop or a "push-pull" approach to prevent the problem from spiraling out of control within the season or from building up to unmanageable levels over the years.

*Crucifer flea beetle.*

**Life Cycle.** The crucifer flea beetle (*Phyllotreta cruciferae*) is uniformly black and shiny, while the striped flea beetle (*Phyllotreta striolata*) has two yellow stripes on its back. Both are about 2 mm in length and hop away when disturbed. These flea beetles only feed on brassica crops; those found on corn or solanaceous crops are different species. Though they prefer the tender leaves of *Brassica rapa* & *B. juncea* crops such as arugula, tatsoi, mizuna, bak choi, and mustard, they will also feed on the more waxy *Brassica oleracea* crops such as broccoli, cabbage, kale and collard. Their feeding damage—small, round holes on leaves or leaf margins, which can coalesce to form large holes as leaves mature—can

*Striped flea beetle.*

destroy or delay maturity in seedlings and reduce yield and marketability of older plants. The adults in fields now will lay their eggs in the soil. Larvae will feed on the root hairs of brassica crops, pupate underground, and emerge as adults in late July to feed on fall brassicas before moving outside of the field for the winter.

**Management. Break the cycle!** Plant spring crops far from fields where fall brassicas

*Surround protects young foliage and can be used to "push" beetle to more preffered crops where they can be controlled using less material and time. Photo by S.B.Scheufele.*

were grown, and where flea beetles will overwinter. When overwintering beetles emerge, if they can't find a host plant they will not survive and reproduce and you will reduce the population of flea beetles on your farm. You can also starve the overwintering beetles by delaying planting until July. This may not easily fit your markets, but it does work. With no food or place to lay eggs, the overwintered adults leave the area, instead of reproducing and emerging in time for midsummer dining. It may take 2-3 years to bring populations down. Control weeds at the same time. The best protection for a spring brassica planting is isolating the crop from where the beetles would have overwintered, near last years' fall crop. Finally, separate your fall crop from the spring crop, since second generation flea beetles will emerge at the same time that fall cole crops will be at their most vulnerable. These second generation adults are also the beetles that overwinter, so next spring, plan to use a field distant from previous late-season brassica fields. After harvests, till crop residue immediately to uproot and kill underground larval populations.

**Row covers.** Floating row cover provides the most effective protection from flea beetles, especially in spring and early summer. It is expensive in both materials and time, but it works. It is critical to seal the edges immediately after seeding, because brassica seeds germinate quickly and beetles rapidly find the cotyledons. Flea beetles can fit through small openings – not to mention the large holes and tears that often develop in row cover over time. Edges of the cover must be sealed on all sides using soil, black plastic bags filled with soil, or some other method. Fortunately hoops are not needed on brassica crops, but management is still time-consuming because the cover has to be removed for cultivation. Replace it as soon as possible to avoid letting beetles in.

Other insect barriers, such as Proteknet, Biothrips, and Filbio, are available in a range of mesh sizes and can be used to protect against a variety of pests, including flea beetles. These provide less heat and greater air circulation than spunbonded row covers, though for early spring crops, the additional warming benefit of traditional row covers of various weights may be preferred.

**Chemical control.** Maturing plants should be scouted frequently. When plants are young, an average of 1 beetle per plant or 10% average leaf damage is a reasonable threshold for chemical intervention. Several synthetic pyrethroids (Group 3A), carbamates (Group 1A), neonicotinoids (Group 4A, either as foliar or soil drench), and the relatively new diamide class (Group 28) are labeled for flea beetle in brassicas. Avoid repeated use of one type of chemistry over multiple generations or using both soil and foliar applications of the same group. Note that as of 2012, the registration for Thionex has been cancelled and is no longer allowed on cole crops. Soil-applied systemic insecticides, such as Admire Pro and Actara can provide longer term control against damage, although beetles may still be seen when scouting. Products containing the new active ingredient cyantraniliprole, a diamide (Exirel for foliar applications; Verimark for soil), are labeled for flea beetle and have been shown in trials to have good efficacy against this pest. Be aware that systemic insecticides may have longer days to harvest intervals. With foliar sprays, even if good control was achieved, re-infestations can occur rapidly and may require additional sprays.

For organic farmers, the choice of chemistries includes spinosad (Entrust) and pyrethrin (Pyganic). In UMass trials, Entrust showed the greatest efficacy in suppressing flea beetles and reducing damage, while Pyrethrin (Pyganic EC 5) showed poor to moderate efficacy in our trials but is reported by growers to cause a significant short-term knockdown. Abby Seaman, NYS IPM, found in 2012 trials that both kaolin (Surround WP) and hot pepper wax worked well. They did not prevent enough feeding for salad greens to be marketable, but they did prevent enough feeding for broccoli, cauliflower, cabbage, etc. to outgrow the damage. In 2013 NYS trials, Entrust, as well as both Venerate and Grandevo, two OMRI-approved bioinsecticides, were all found to significantly reduce damage from flea beetle on cabbage under low pest pressure. Another promising organic product is Azera, a mix of azadirachtin and pyrethrins. A 2011 University of Maryland trial found that Azera significantly reduced flea beetle feeding damage, and that mixed with Surround, it both reduced feeding damage and maintained efficacy over time.

**Control brassica weeds.** Brassica weeds also harbor flea beetles (both adults and larvae) and reduce the efficacy of your crop rotation schemes that aim to break the pest cycle by changing crop families. Yellow rocket, wild mustard, and shepherd's purse are familiar weeds that are widespread in fields and roadsides. The list of weed hosts probably also includes garlic mustard (*Alliaria petiolata*), a serious invasive weed in the brassica family. It is a biennial with white blooms in spring (May). It thrives in roadsides and field edges as well as shady woodlands, and has rapidly spread throughout Massachusetts. A good fact sheet on garlic mustard can be found at: http://www.nps.gov/plants/alien/fact/alpe1.htm or through the Invasive Plant Atlas of New England (IPANE) website.

**Trap cropping.** Take advantage of the flea beetle's preferences for particular brassicas by using the preferred species or varieties as a draw. Their numbers will build up in the more attractive plants, and are less likely to move into or stay in those less preferred. A border or even a middle row planted to *Brassica rapa* or *B. juncea* crops such as Komatsuna, tatsoi, mizuna, bak choi, and mustard has been shown to reduce numbers and feeding damage on less preferred *B. oleracea* crops such as broccoli, cabbage, or traditional kale (eg, Winterbor types). Red Russian kale (*B. napus*) and Lacinato kale (*B. oleracea*) seem to be of intermediate attractiveness. To make it work, here's some tips:

- Make sure the trap crop is established before the main crop (the one you are trying to protect) or is at least as big (e.g. transplanted same day). Direct-seeded crops can be used around transplants if seeded 7-14 days earlier.
- Use a fast-growing, vigorous cultivar for the trap crop.
- Use a border crop to prevent beetles from moving farther into the field. Traps at ends of rows help make a complete perimeter, which stops beetles coming from all directions. Interior trap crops also can act as a 'sink' within the field.
- Spray only the trap crop to kill the accumulated beetles, and avoid having to spray the main crop. You also want to keep the trap crop viable enough to do its work, and potentially be harvestable as well. Use a longer-residual product, if possible.
- Combine with a repellent on the main crop. Surround WP and garlic sprays can be used for this purpose.

A variation on this theme is the push-pull system, in which most of the brassica crop is treated with a repellent such as Surround, to "push" the beetles to a sensitive crop (e.g. bok choy or mustard), which is left untreated. This strategy limits the amount of time and material used in controlling the pest, since you only need to spray the "pull" crop, instead of all of the brassica acreage with an insecticide. The trick is to catch the beetles on the sensitive crop before they cause too much damage there, or make the "pull" crop something you don't intend to harvest, like an extra row of direct-seeded mustard. We saw this work really well on a farm in MA where flea beetles had built up to very high levels and were a major production challenge. When the farmers combined this strategy with crop rotation, separating spring from fall fields and going into a field that had been out of brassicas several years, the results were impressive. So there is hope!

**Resource:** Hazzard, R. "Materials for Beating Flea Beetles in Brassicas". New England Vegetable and Fruit Conference, 2005 Conference Proceedings: http://www.newenglandvfc.org/2005_conference/sessions_05/biorantional_biological_pest_control/Materials%20for%20__Beating%20Flea%20Beetles%20in%20Brassicas%20.pdf

*--Updated by L. Mckeag and S.B. Scheufele, Umass Extension Vegetable Program.*

# Events

## Special Topics for Pesticide Applicators

**When:** Wednesday June 15th, 2016 from 1:15pm to 3:30pm
**Where:** Doubletree Hotel, 11 Beaver Street, Milford, MA 01757

This two hour program will provide two recertification contact hours for all categories of pesticide licenses, Natalia P. Clifton, UMass Extension will discuss a variety of timely topics of importance to pesticide applicators. Topics will include EPA regulatory changes impacting pesticide applicators, events involving pesticide impacts on non-target organisms, resources for pesticide toxicity and environmental impact information, pesticide poisoning incidents, and the new draft MA state pollinator protection plan. Two pesticide contact hours for licenses in all Massachusetts categories. Contact hours are valid for equivalent categories in all New England states. The registration fee is $35.00 per person.

Online registrations include an additional service fee.

For information on registering for these workshops please refer to our website at www.umass.edu/pested

Please contact Natalia Clifton, UMass Extension , 413-545-1044 or email nclifton@umass.edu

## How to Conduct an On-Farm Trial

**When:** Tuesday, July 12th, 2016 from 3:00pm to 5:00pm

**Where:** UMass Crop and Animal Research and Education Center, 89 River Rd. Deerfield, MA

Ever want to apply for a SARE farmer or partnership grant? Looking to improve your farming practices through research? This workshop is for you! Farmers and Agricultural Service Providers welcome. We will provide hands-on training in setting up a replicated field plot, and include practice taking measurements and collecting data. Concepts learned can help you answer many questions through on-farm trials, but this workshop will focus on the UMass trial "**Nitrogen contribution from cover crops for vegetable crop uptake**" being conducted on multiple farms in Massachusetts this fall as a way to prepare cooperating farmers to conduct this trial.

Stay tuned for a follow-up workshop on data analysis and interpretation of results.

Free, but please RSVP: https://www.surveymonkey.com/r/OnFarmTrial

**Questions? Contact:** Katie Campbell-Nelson, kcampbel@umass.edu, 413-545-1051

*Supported in part by USDA/NE-SARE Professional Development MA State Program.*

## IPM Field Walks

In this series, learn to identify and scout for vegetable pests and select integrated pest management strategies that work for you, whether you are an experienced farmer, or just starting out, organically certified or not! We will use pheromone traps to monitor pests, use a microscope to identify plant pathogens, and learn to scout in multiple vegetable crops with UMass Extension Vegetable Program staff Katie Campbell-Nelson, and Plant Diagnostician Angie Madeiras. Scouting will be followed by a discussion of effective control strategies with growers in attendance. Bring a hand lens if you have one. *Supported in part by funding provided by USDA-NIFA Extension Implementation Program, Award No. 2014-70006-22579*

**June 28th, 4-6 pm**
Wards Berry Farm, 614 South Main Street, Sharon, MA 02067
Farmer: Jim Ward

**July 19th, 4-6pm**
Alprilla Farm, 94 John Wise Avenue, Essex, MA 01929
Farmer: Noah Kellerman

**August 2nd, 4-6pm**
Red Fire Farm, 184 Meadow Rd, Montague, MA 01351
Farmer: Ryan Voiland

**Questions? Contact:** Katie Campbell-Nelson, kcampbel@umass.edu, 413-545-1051

## Vegetable Winter School

**When:** Tuesdays, January 10th, 2017 – February 21st, 2017 from 9am – 3:30pm

**Where:** Central Massachusetts, TBD

Save the dates for this course designed to provide growers with regulatory certainty in a time of many regulatory changes. Leave winter school ready for a Commonwealth Quality Program (CQP) audit and the peace of mind that you are prepared to handle the requirements of: the Food Safety Modernization Act (FSMA), EPA Worker Protection Standards (WPS), Nutrient Management Regulations, and changes in Employment Law. Get up to date on research and IPM practices important to vegetable growers and gain a competitive advantage in a heavily regulated market.

Each farm will get detailed support in developing food safety and nutrient management plans, training employees in WPS, developing standard operating procedures compliant with regulations, and preparing an employee handbook and a whole farm IPM plan. Twelve contact hours available for the vegetable pesticide license category. This course is designed for farm owners, managers and employees. Registration opens in September 2016.

**Registration opens in September 2016**

**1/11/2017 – Food Safety Produce Rule.** Instructors: Lisa McKeag (UMass Extension Vegetable Program) and Michael Botelho (MDAR Commonwealth Quality Program)

**1/17/2017 – Food Safety Preventive Controls Rule.** Instructors: Amanda Kinchla (UMass Extension Food Science Extension Faculty) and Michael Botelho

**1/24/2017 – Soil and Nutrient Management**. Instructors: Katie Campbell-Nelson (UMass Extension Vegetable Program) and TBD

**1/31/2017 – EPA Worker Protection Standards.** Instructors: Natalia Clifton (UMass Extension Pesticide Education) and TBD

**2/7/2017 – Advanced Topics in Integrated Pest Management.** Instructors: Angie Madeiras (UMass Extension Plant Diagnostician), Sue Scheufele (UMass Extension Vegetable Program)

**2/14/2017 – Employee Management and Labor Laws.** Instructors: TBD

**2/21/2017 – Incentive Programs (NRCS, MDAR, SARE) and Risk Management.** Instructors: Tom Smiarowski and Paul Russell (UMass Extension Risk Management Specialists)

**2/28/2017 – Snow Date.**

**Questions? Contact:** Katie Campbell-Nelson, kcampbel@umass.edu, 413-545-1051

## THANK YOU TO OUR SPONSORS

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