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

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## In this issue:



## Crop conditions

Lots of garlic was harvested in the last few weeks during the dry spell, and is curing now for storage. Field tomato harvests have started to pick up, and summer cucurbit successions have been bountiful. The wetter weather this week has resulted in more pathogens being reported on tomatoes, cucurbits, and other crops. Luckily though, most of the recent storms have been traveling directly north and skirting Massachusetts to the west, and the risk of accompanying pathogens like cucurbit downy mildew and late blight remain greater in eastern New York than in Massachusetts. Not all is risk-free however – we have seen an increase in corn earworm as a result of these storms.

*Kevin O'Dwyer and twilight meeting attendees assessing the weed pressure in direct-seeded carrots before flame weeding.*

The intermittent rain this week has made it difficult for farmers to get anything done, especially spraying, cultivation, and anything requiring the use of heavy equipment, with trucks and tractors alike getting stuck in muddy fields. Thankfully we had dry weather in eastern Massachusetts on Tuesday for our Organic Weed Management Twilight Meeting at Langwater Farm in North Easton. This was a convenient day for Langwater's crew to get a lot of cultivation done on their germinating direct-seeded fall crops, so we got to see basket weeding of germinated beets with an Allis Chalmers G, and flame weeding of pre-emergent carrots. See the article this issue for a summary of what we learned from presenters at the twilight meeting.

We have a few more great events coming up in our summer twilight meeting series this year. Our next meeting will be a research tour at the UMass Crop and Animal Research and Education Center in South Deerfield, MA on August 14th. Join us to learn about our current research and get 1.5 pesticide credits. See the events section for more details and to register.

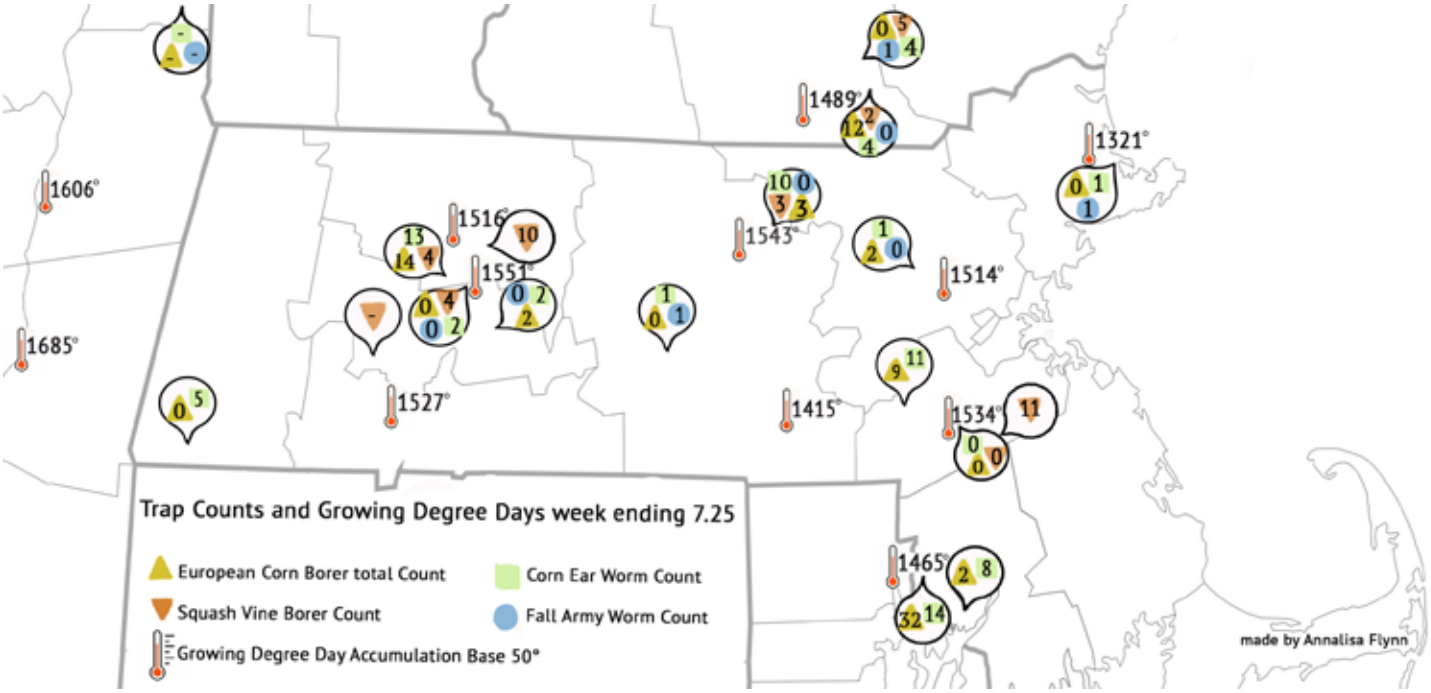
## Pest alerts

**Brassicas:**

Alternaria leaf spot has been observed in broccoli in Hampden Co., MA. This fungus can overwinter on crop residue, so make sure to deeply incorporate crop debris promptly after harvest is complete, especially of thick-stemmed brassicas, to encourage breakdown of infected tissues.

**Chenopods:**

Black blister beetle was found in a Bristol Co., MA field, feeding on chard and leaving behind messy piles of frass. This long, black beetle (photo) is active July through September. Larvae of this beetle eat grasshopper eggs. Adults may affect other vegetable




crops, eating foliage—with a preference for chard. They produce a toxin and can burn hands, so wear gloves when handling them.

**Cucurbits:**

Squash vine borer: Peak flight of adult moths has passed; larvae may be feeding now, leaving boring tunnels and wilted plants. There can be 2 generations per year, with the first generation larvae and pupae present now and the second generation arriving around September. The second generation can damage fruit, especially if vines have gone by.

Cucurbit downy mildew: Still no reports in MA. These recent storms moving up the east coast are going straight north through NY, west of New England. New England remains at low and moderate risk. Monitor the forecast here: http://cdm.ipmpipe.org/current-forecast

Powdery mildew is present now in several MA counties. It is time to begin spraying fungicides if 1 in 50 leaves are infected. See Meg McGrath's article "Effectively Managing Cucurbit Powdery and Downy Mildews" in the June 21st, Vegetable Notes to select materials for your regimen.

*Bacterial leaf spot on pepper.*

**Solanaceous:**

Bacterial leaf spot was confirmed on pepper in Worcester Co, MA (photos). Once established, this disease is difficult to control. The disease was worst in a purple pepper, several hot varieties, Karma, and Flamingo. Several varieties have resistance to certain races of the pathogen. Disease symptoms were less severe in Early Sunsation (1-3), Charisma, Banana Key Largo, Declaration (1-5), and Aristotle (1-3). Numbers in parentheses indicate which races of leaf spot the peppers are resistant to. There are now 10 races of bacterial leaf spot. Select varieties that are resistant to the most races for optimal resistance next year, consult this table to find resistant varieties: http://vegetablemdonline.ppath.cornell.edu/Tables/TableList.htm

*On the right: Amish Paste, Pink Berkshire Tie dye, and On the left: Geronimo and Rebelski*

Leaf mold has been seen on high tunnel tomatoes in Berkshire, Franklin and Worcester Cos. this season. This week, our summer scout, Annalisa, saw major differences between resistant and susceptible varieties on one farm (photo).

**Sweet Corn:**

European corn borer: The second generation flight has begun in earnest, and trap counts are increasing on some farms (map). The importance of this pest varies from farm to farm, as it is not migratory and is localized to certain fields. Therefore, trapping is especially useful for this pest. The threshold for control is 7 moths per trap per week. You may be able to forgo traditional control measures such as releasing *Trichogramma ostriniae* wasps if you are not reaching this threshold.

Table 3. Spray Intervals for Corn Earworm based on moth captures in Heliothis net traps.

| Moths/Night | Moths/Week | Spray Interval |
|---|---|---|
| 0 - 0.2 | 0 - 1.4 | no spray |
| 0.2 -0.5 | 1.4 - 3.5 | 6 days |
| 0.5 - 1 | 3.5 – 7 | 5 days |
| 1 - 13 | 7 – 91 | 4 days |
| Over 13 | Over 91 | 3 days |

Corn earworm numbers have increased slightly this week as they are carried north on storm fronts from our south. Some locations are now at 4 day spray schedules (see table).

Fall armyworm has arrived in MA, but remains at very low numbers. Keep an eye out for this pest and scout when corn earworm thresholds are too low to spray.

**Multiple:**

Potato leafhopper is continuing to cause hopper burn in beans, eggplant, and potato throughout the state. Stay on top of this pest to avoid yield losses. In potato, yield loss occurs even before the development of obvious symptoms. Green beans are very susceptible, especially when they are infested prior to flowering.

## VERTICILLIUM WILT IN EGGPLANT

In the past few weeks, symptoms of Verticillium wilt have been showing up in eggplant across the region. Verticillium wilt is caused primarily by two fungi in the genus *Verticillium*. These pathogens are soil-borne and can persist in soils for long periods of time without a susceptible host, making disease management difficult. Verticillium wilt can affect many vegetable and ornamental crops and has many weed hosts as well, but eggplant is particularly susceptible.

Early stages of Verticillium wilt result in one-sided yellowing, wilting, or scorching (see photo). *Verticillium* spp. usually infect a limited section of plant roots and colonizes the water-conducting cells above that point, blocking the flow of water to certain sections of the plant. Symptoms of the disease therefore initially appear in only one branch or one side of a leaf because other water-conducting "pipes" remain un-colonized and can conduct water normally. In contrast, other root and crown rot pathogens like *Pythium*, *Phytophthora*, *Rhizoctonia*, and *Sclerotinia*, infect the whole vascular system uniformly, resulting in the entire plant wilting. *Verticillium* spp. also generally cause a brown discoloration of the vascular system, especially at the base of the stem. The discoloration can be observed by splitting the stem down the middle (see photo); the vascular system is just under the outer skin of the plant, not in the center.

Verticillium wilt is primarily spread through infested soil or infected plant material—transplants and potato seed. The fungus is soil-borne and does not easily move around the field. Plowing and harrowing will spread the pathogen down the row a bit, but the pathogen will likely not spread throughout a field during the season the way a fungus that produces wind-blown spores would. Nevertheless, continuous planting of susceptible crops will build up the population density of *Verticillium* and reduce yield of subsequent crops. *Verticillium* spp. can survive in the soil for many years after being introduced by producing microsclerotia—masses of compact hyphal cells that are highly resistant to desiccation and UV light. In the presence of susceptible hosts, microsclerotia will germinate and infect. Disease development is favored by moist soils and temperatures between 70 and 81°F.

Because Verticillium wilt has such a wide host range, it can be difficult to rotate away from susceptible hosts. The list of crops susceptible to Verticillium wilt is very long and includes vegetables, flowers, herbaceous perennials, and trees. Vegetable crops that *Verticillium* has been reported on include brassicas (cabbage, radish), cucurbits (cucumber, melons),

other solanaceous crops (tomato and potato), peppermint, and lettuce, with the most extensive reporting on solanaceous crops. There is a strain that attacks peppers, but that strain has not been seen in the eastern US. When Verticillium wilt is confirmed in a field, we can only advise to plant crops that are known to be resistant to the fungus as a whole. Vegetables that are resistant to Verticillium wilt include asparagus, beans, peas, and corn. Most grasses are also resistant—so including grass cover crops in rotations can be helpful.

**Management:**

- Chemical control: There are currently no effective chemical controls.
- Crop rotation is most effective if used preventively to stop the buildup of inoculum in the soil. Crop rotation can slow pathogen population growth somewhat once it has been introduced into a field, but because microsclerotia of Verticillium spp. are so long-lived, even long rotations away from susceptible hosts are not guaranteed to be 100% effective
- Use tolerant cultivars. There are no resistant eggplant varieties, but some varieties, including Epic, Long Purple, Rosa Bianca, Casper, and Classic may maintain high yields despite infection. Many tomato varieties are listed by seed companies as having resistance to Verticillium wilt.
- Start with pathogen-free plant stock.
- Soil fumigation and solarization can effectively kill *Verticillium* inoculum. See the New England Vegetable Management Guide for more information on soil fumigation. Here is a useful guide on soil solarization for disease, nematode, and weed control from UC Davis: http://vric.ucdavis.edu/pdf/soil_solarization.pdf

*--Written by Bess Dicklow and Genevieve Higgins*

## GARLIC HARVEST, CURING AND STORAGE

While many growers got their garlic pulled before this rainy week, some may still be thinking about it. Timing the harvest can be tricky—heads should be left in the ground as long as possible to attain maximum bulb size (which doubles in the last stage of growth), but not so long that the cloves begin to separate, as overripe bulbs sell and store poorly. Harvest when leaves begin to turn yellow, but when about 60% are still green. Check bulbs by cutting through the head sideways to see how well developed the cloves are. Cloves should fill the wrappers - if they seem a little loose, the garlic has a little ways to grow. A little of the outermost wrapper may have started to discolor at this point. Harvest before the bulbs pop, which can happen relatively quickly, especially in a wet year. Remember that it is better to harvest too early than too late.

*Absence of roots on a portion of the basal plates can be a symptom of infection with bloat nematode. Photo by S. Johnson*

Use hand tools to loosen soil under the bulbs or a mechanical harvester to undercut the bed. Pulling bulbs out when they are tight in the ground can open wounds at the stem-bulb junction and allow for fungal infections. Fresh bulbs bruise easily and these wounds can also encourage infection. Don't knock off dirt by banging bulbs against boots, shovels, or buckets – shake or rub gently, and leave the rest to dry out during curing.

Curing is important for successful bulb storage and finding the ideal conditions for curing can be a challenge. Curing in the field runs the risk of sunscald, while curing in poorly ventilated barns can result in yield loss from disease. Avoid high temperatures (over 90°F) and bright sunlight. Rapid curing can be achieved by placing bulbs roots up on 1" wire mesh in a hoophouse covered with a shade cloth, and with the sides and ends open. A well-ventilated barn will also work, but be sure that bulbs are hung with adequate air circulation or on open racks up off the floor. Curing takes 10-14 days. Stems may be cut before or after curing. Curing is complete when the outer skins are dry and crispy, the neck is constricted, and the center of the cut stem is hard.

Storing Bulbs. After curing, garlic can be kept in good condition for 1 to 2 months at ambient temperatures of 68 to 86 °F under low relative humidity (< 75%). However, under these conditions, bulbs will eventually become soft, spongy and shriveled due to water loss. For long-term storage, garlic is best maintained at temperatures of 30 to 32°F with low RH (60 to 70%). Good airflow throughout storage containers is necessary to prevent any moisture accumulation. Under these conditions, well-cured garlic can be stored for 6-7 months. Storage at higher temperatures (60 °F) may be adequate for the short term, but it is important to select a place with low relative humidity and good air flow. As with onions, relative humidity needs to be lower than for most vegetables because high humidity causes root and mold growth; on the other hand, if it is too dry the bulbs will dry out.

Storing Seed. Garlic bulbs that are to be used as seed for fall planting of next years' crop should be stored at 50 °F and at relative humidity of 65-70%. Garlic cloves break dormancy most rapidly between 40 to 50 °F, hence prolonged storage at this temperature range should be avoided. Storage of planting stock at temperatures below 40°F results in rough bulbs, side-shoot sprouting (witch's-brooms) and early maturity, while storage above 65°F results in delayed sprouting and late maturity.

Garlic cloves used for seed should be of the highest quality, with no disease infections, as these can be spread to new fields and to next years' crop. Be on the lookout for symptoms of stem and bloat nematode which include shrunken, soft cloves and sometimes roots are missing or from the basal plate. Infestation with this nematode can also make them more susceptible to secondary infections with other pathogens and affected bulbs may not store well. The UMass Plant Disease Diagnostic Lab can make a positive identification; for submission instructions and contact info visit http://ag.umass.edu/services/plant-diagnostics-laboratory.

*-R. Hazzard*

## CULTURAL PRACTICES FOR WEED MANAGEMENT

Kevin O'Dwyer and crew at Langwater Farm in North Easton, MA hosted a lovely twilight meeting on Tuesday this week to a crowd of over 40 farmers and agricultural service providers. Kevin framed the program well, stating "weeds are the most costly pest that we deal with on our farm." Thankfully, he and other presenters in attendance have developed methods that can help us all be more successful in our weed management strategies. Here are tips on different techniques used in weed management from our twilight meeting presenters this week:

**Leaf Mulching** – is a practice of spreading chopped up leaf mulch between plastic beds to eliminate the need for cultivation.

- **Good for:** garlic, and between plastic.
- **Tips for success:** Make sure to get leaves that are free of potential herbicides. Kevin gets free leaf mulch from landscapers in the fall, and stores them in piles on his farm to be used the following spring, 5-6 months later. Leaves are spread in May right after plastic is laid for warm season crops such as pepper, tomato, cucumber, summer squash, zucchini or in the fall over his garlic. Leaves are applied to fields with a side discharge manure spreader, which chops them up as they are spread. A farm crew follows behind with upturned rakes to brush the mulch off the beds but keeping a good amount along the edges where there are the most problems with weeds. Make sure the leaf mulch is about 3 to 4 inches deep to ensure adequate cover; too thin a layer will be ineffective. Kevin estimates that he uses 150-200 yards of leaf mulch per acre (at fairly low density). When there are weed escapes, Kevin waits until after a good rain to hand pull weeds rather than using hoes so as not to further disturb the soil which allows dormant weed seeds to germinate. Immediately after harvest, the entire field is harrowed perpendicular to the direction the crop was grown to evenly distribute the leaf mulch, and a cover crop is planted. Any nitrogen sink caused by the leaf mulch may be visible in a cover crop, but is gone by the next season when another crop is planted. The practice of leaf mulching also has the benefit of adding organic matter to the soil without adding too much additional nutrients (including phosphorous).

**Flame Weeding** – Uses propane powered single wand backpack, push, or tractor-mounted multiple wand units to control weeds before crop emergence in direct seeded crops.

- **Good for:** small, direct seeded crops such as carrots and beets, or even crops such as beans and sunflowers. Good for

broadleaf weeds and germinating purslane, but less effective on sedges, grasses, or purslane spread by cultivation.

- **Tips for success:** Kevin's tractor-mounted flame weeder covers one bed at a time, and eliminates hours of thumb weeding in carrots or collinear hoeing after the first seeding in April. The earliest planting of carrots and beets still needs to be hand weeded because it is too early in the spring for weeds to germinate before the crops do. Ideally, a field is prepared 3-4 weeks in advance of seeding. After a rain, a first flush of weeds will germinate and one pass with the flame weeder will kill them. Then, the crop is seeded, and 2-3 days before the crop germinates, more weeds should be visible and the flame weeder will go over the field again. One farmer recommended using a piece of plexi-glass laid over a seeded section of the field, which will increase soil temperatures and speed up germination. When germination of the crop under the plastic is seen, that is the time to flame the rest of the field. One disadvantage to preparing bare ground 3 weeks before planting is that soils tend to form a crust, and it is more difficult for small seeded crops to germinate. Also, carrot seed is very sensitive to heat, and if it has germinated just below the surface, one pass with the flame weeder can kill the crop, so try to flame carrots before the seed has germinated. Kevin drives his tractor-mounted unit over the field at 1.5mph. Once, using a laser thermometer, he measured 600°F on the soil surface right after the unit had passed. Kevin's unit has 5 torches, each putting out about 100,000 BTUs. A simple way to ensure that the flame weeding was effective is to press a treated weed leaf between the thumb and forefinger looking for a dark green thumbprint. This darkened coloration indicates that plant cells have burst, and water is escaping them when pressed (ie. the weed is dead). Don't flame weeds right after a rain or if there is condensation on weeds since more BTU's will be required to kill them. Also, keep the ignitors clean since they tend to rust up, making it difficult for the unit to light. At the twilight meeting after party, we learned that a shielded unit like Kevin's is "way better" because more heat is trapped over the bed, and another employee doesn't have to follow behind the unit with a shovel to put out fires!

*UMass Extension Weed Specialist Katie Ghantous demonstrates her vinegar-powered weed sprayer.*

**Vinegar Injection** – is a somewhat experimental method using 10% acetic acid injected into the weed's root zone to kill it. This method is more commonly used by weed specialist Katie Ghantous in cranberry systems where soil pH is lower than in vegetable systems.

- **Good for:** perennial weeds, including horse nettle, clumping grasses such as foxtail, and spot treatment of weeds such as on the ends of plastic rows.
- **Tips for success:** Green Gobbler is the only OMRI listed vinegar product, but does not have an EPA registration. Other commercial vinegars are allowable under national Organic Standards (pending local ordinances). Household vinegar from a grocery store contains only 5% acetic acid and therefore is not strong enough. Horticultural vinegar must be purchased. If using vinegar to control weeds, make sure to use a product labeled for this use. Katie Ghantous fashioned an injector out of a 4ft. long piece of ¼" hollow aluminum cut at an angle and threaded on one end to attach to a solo backpack sprayer. She then calibrated her backpack sprayer to aliquot 40 mls of liquid at each squeeze of the trigger. The end of the injector is inserted into the root zone of the weed, about 2-4 inches deep, then the trigger is pulled. After a few days, the weed will begin to yellow and die.

**Tarping** – using clear plastic for solarization (trapping light and heat in) or black plastic for occulation (blocking light out and absorbing heat) before planting into a reduced tillage system has several benefits. Sonja Birthisel, PhD candidate from the University of Maine, has researched these two methods for weed control and offers the following results:

- **Good for:** stale seed bedding areas up to 30 x 100 ft, or in greenhouses and high tunnels.
- **Tips for success:** In the 2 years that Sonja conducted trials, solarization provided better weed control in 2016, and oc-

culation provided better weed control in 2017. So, the jury is still out about which method provides better weed control, but either way, cultivation can be avoided when tarps or plastic are placed on the soil surface 3-6 weeks before planting. Used clear plastic from a high tunnel or greenhouse has been shown to be more effective than new plastic. Yay for recycling agricultural waste! Both clear and black plastic tarps may benefit from being buried around the edges with soil, especially in windy locations. This is especially true for solarization with clear plastic, which may prove ineffective if edges aren't tightly secured. For use over multiple years, use 6 ml weight plastic or heavier. Sonja found that soil microbiological activity was reduced 5 days after removing tarps compared to uncovered control plots, but that microbial activity had bounced back after 14 days. She also found that there was significantly more nitrogen available under covered plots after the plastics were removed.

*Sonja's 2016 field experiment comparing solarization and occultation, Rogers Farm, Old Town, ME.* https://gallandt.wordpress.com/2017/06/01/comparing-solarization-occultation/

Resources: Weed Management for Organic Farmers: https://gallandt.wordpress.com/

*--Written by Katie Campbell-Nelson with many thanks to: Kevin O'Dwyer, Katie Ghantous, Tyson Neukirch and Sonja Birthisel for presenting this information on July 24th, 2018 at the "Organic Weed management Twilight Meeting" on Langwater Farm, North Easton, MA.*

# Events

**UMass Extension Vegetable Program Research Tour and Round Table**

**Featuring:** Sue Scheufele's research on cucurbit downy mildew resistance, pollinator protection in butternut squash, effects of different mulches on broccoli pests, and natural predators of cabbage aphid. Also, Madelaine Bartlett's research on corn genetics and the importance of genetics in crop development and improvement, Omid Zandvakili's research on lettuce nutrition, Kelly Allen's research on Fusarium wilt of basil, presentations on pollinators & agriculture and solar & agriculture, and more! Research presentations will be followed by dinner and a round table discussion.

**When:** Tuesday, August 14th, 2018 from 4:00 PM to 7:00 PM (Rain date: August 16th)

**Where:** UMass Crop and Animal Research and Education Farm, 89-91 River Rd., South Deerfield, MA 01373

**CLICK HERE TO REGISTER:** https://www.surveymonkey.com/r/X3JYR55

Click here to request special accommodations for this event.

**Reduced Tillage and Transplanters for Vegetable Farmers**

**Featuring:** Farmer Jim Ward and his reduced till vegetable cropping systems which he has practiced for over 10 years with the help of an Unverferth Deep Zone Tiller, Davidian Farm's two-row Monosem vacuum precision planter mounted with Dawn Biologic roller crimpers (first ones in the state!), the UMass Research Farm's grain drill and roller crimper, and Brookdale Fruit Farm's new line of no-till transplanters from Checchi-Magli. There will also be demonstrations on Soil Health with Maggie Payne, Soil Scientist at NRCS.

**When:** Tuesday, August 28th, 2018 from 4:00 PM to 7:00 PM

**Where:** Ward's Berry Farm, 614 S Main St., Sharon, MA 02067

**CLICK HERE TO REGISTER:** https://www.surveymonkey.com/r/XF8JQYD

Click here to request special accommodations for this event.

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