UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

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Tomatoes season is well underway! Green tomatoes in a high tunnel in Hatfield, MA. Photo: S.B. Scheufele

Crop conditions

Lots of beautiful crops are coming in, with eggplants and peppers getting tacked on to harvest lists along with sugar snap peas, tomatoes, summer squash, zucchini, cucumbers, lettuce, kale, collards, beets, carrots, fresh herbs, and more. We've seen very little disease pressure out there so far—one of the silver linings in a dry period, though I guess that's not the most apt metaphor given these largely cloudless skies! Insect pressure has been fairly low too on the farms we've been scouting; growers seem to be controlling these pests well. We're still getting a little rain periodically, a quarter- to half-inch in most places. Not enough to really soak things but enough to keep the panic at bay. We've heard that well drillers are in high demand and hard to get a hold of.

Some farms are still struggling with being understaffed, especially with continued irrigation demands, longer harvest lists, and fall crops needing to get in the ground. It's normal this time of year to see weeds start to get away from folks with so much else to do. Being strategic about when you cultivate can help you make the most of your limited time. Weeds and crops are in a race to get bigger and take up water and nutrients. Getting weeds before they can compete, during the "maximum weed-infested period", will give your crops their best shot. See the article this issue on knocking out weeds at critical times.

Pest alerts

Beans

Mexican bean beetle eggs are being observed and larvae are expected soon. Target hatching eggs if using the biocontrol organism *Pediobius foveolatus*.

Cucurbits

Leaf spots are starting to pop up on cucumbers and melons. So far, diagnosed samples include **angular leaf spot**, a bacterial disease (see next page for photo), and ***Alternaria***, a fungal leaf spot. No signs of powdery or downy mildews yet in New England.

Nightshades

The summer generation of **Colorado potato beetle** adults has begun to emerge, and we are now seeing adults, eggs, small larvae and large larvae. This insect develops resistance to insecticides quickly, and one key strategy to controlling them long-term is to switch insecticide classes between generations. This means if you used Entrust on the overwintering generation you should not use it again on this next generation or resistance may develop. For a complete list of labeled insecticides see the potato section of the New England Vegetable Management Guide here.

Contact Us:

Contact the UMass Extension Vegetable Program with your farm-related questions, any time of the year. We always do our best to respond to all inquiries. **Office phone:** (413) 577-3976 *We are currently working remotely but checking these messages daily, so please leave us a message!* **Email:** umassveg@umass.edu

Home Gardeners: Please contact the UMass GreenInfo Help Line with home gardening and homesteading questions, at greeninfo@umext.umass.edu.

Hornworms are being reported in southern New England. These large caterpillars typically appear in small numbers and cause major feeding damage to just a few leaves or plants of peppers, tomatoes, eggplant, potatoes, and related solanaceous weeds. Now is the time to scout by searching leaves for damage, frass or larvae. There is no set economic threshold for this pest in tomato but numbers and damage can reach unacceptable levels especially in a high tunnel. Foliar sprays can be effective—use a selective material that will conserve beneficial insects because those predators and parasites are very likely keeping your aphid populations under control. Insecticides that are specific for caterpillars include *Bacillus thuringiensis* (Bt) kurstaki or aizawi strain (Dipel DF, Agree, or Xentari, etc.), indoxycarb (Avaunt), tebufenozide (Confirm 2F), or spinosad (SpinTor 2SC or Entrust). Several synthetic pyrethroids are also labeled (note: these could result in aphid outbreaks). Although Bt usually works best on small larvae, in this case it will work very well even against large hornworms. In peppers, any controls used for European corn borer should control hornworms.

Angular leaf spot in cucumber

Tomato hornworm larva. Photo: S. B. Scheufele.

White mold (*Sclerotinia sclerotiorum*) was diagnosed this week in tomato where it causes stems or entire plants to die back, turning tan and dry. The pathogen does not infect healthy tissue until after it has colonized dead or senescent plant parts such as flowers or leaves and is favored by cool, moist conditions. Lesions initially appear water-soaked and gradually spread over the stem, eventually becoming bleached and light gray to brown in color. When environmental conditions favor the pathogen, dense white mycelium will develop on the surface of the lesions and large black sclerotia (long-lived resting structures) will develop on the outer surface of the lesions or within the stem. White mold affects many plants and other important vegetable hosts include cabbage, beans, and potatoes. Rogue out infected plants, which may contain sclerotia, and destroy them. Some fungicides (e.g. Endura, Cabrio, Fontelis, Priaxor, Luna Sensation) can suppress disease if used preventively, and the biocontrol product Contans can be used to reduce survival of sclerotia in the soil when used over the fall and winter.

Verticillium symptoms on eggplant are beginning to show up across the region. The disease causes a yellowing of lower leaves followed by wilting. Lesions have a characteristic V-shaped pattern which is widest at the leaf margin. Brown, necrotic tissue within lesions is surrounded by a large, irregular area of yellowing due to a systemic leaf toxin produced by the fungi. Symptoms are subtle and may be confused with insufficient moisture or other vascular wilts or hopperburn. Because Verticillium affects the water-conducting vessels,

Verticillium wilt in eggplant. Photo: G. Higgins.

symptoms can appear on one side of the plant or on one side of a leaf. Leaf necrosis is followed by wilting, stunting, and plant death. When the stems of infected plants are cut lengthwise, the vascular tissue exhibits a brown discoloration. The pathogen survives for long period in the soil. Tomatoes can also be affected. There are no effective chemical controls for Verticillium wilt other than fumigation. Soil sterilization and steaming can kill Verticillium but it can be difficult to achieve hot enough conditions in New England.

Table 1. Squash vine borer trap captures for week ending July 7

Whately	1
Leominster	19
Sharon	6
Southampton	14

Sweet Corn

Western bean cutworm continues to be observed in New York. This is a relatively new pest in the Northeast. Materials used for corn earworm control will also control western bean cutworm. For photos, check out this Purdue fact sheet.

Corn Earworm are still being detected in pheromone traps around the state. For more information, check out this week's corn pest table, and our recent pest alert.

Fall Armyworm moths were caught in pheromone traps in a few MA locations this past week. In general, FAW is the last corn moth to show up in the Northeast, and CEW sprays will also control FAW.

Table 2. Spray intervals for corn earworm based on moth captures in Heliothis net traps.

Moths per Night	Moths per 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

Multiple Crops

Tarnished plant bugs are still out causing damage to various crops. These obnoxious critters usually feed in flower buds (e.g. strawberries and broccoli crowns) but can also damage leafy crops where they feed at leaf tips and petioles causing deformation of leaves and plants.

Scarab beetles are out in force in various crops and especially basil, see article this issue for more information.

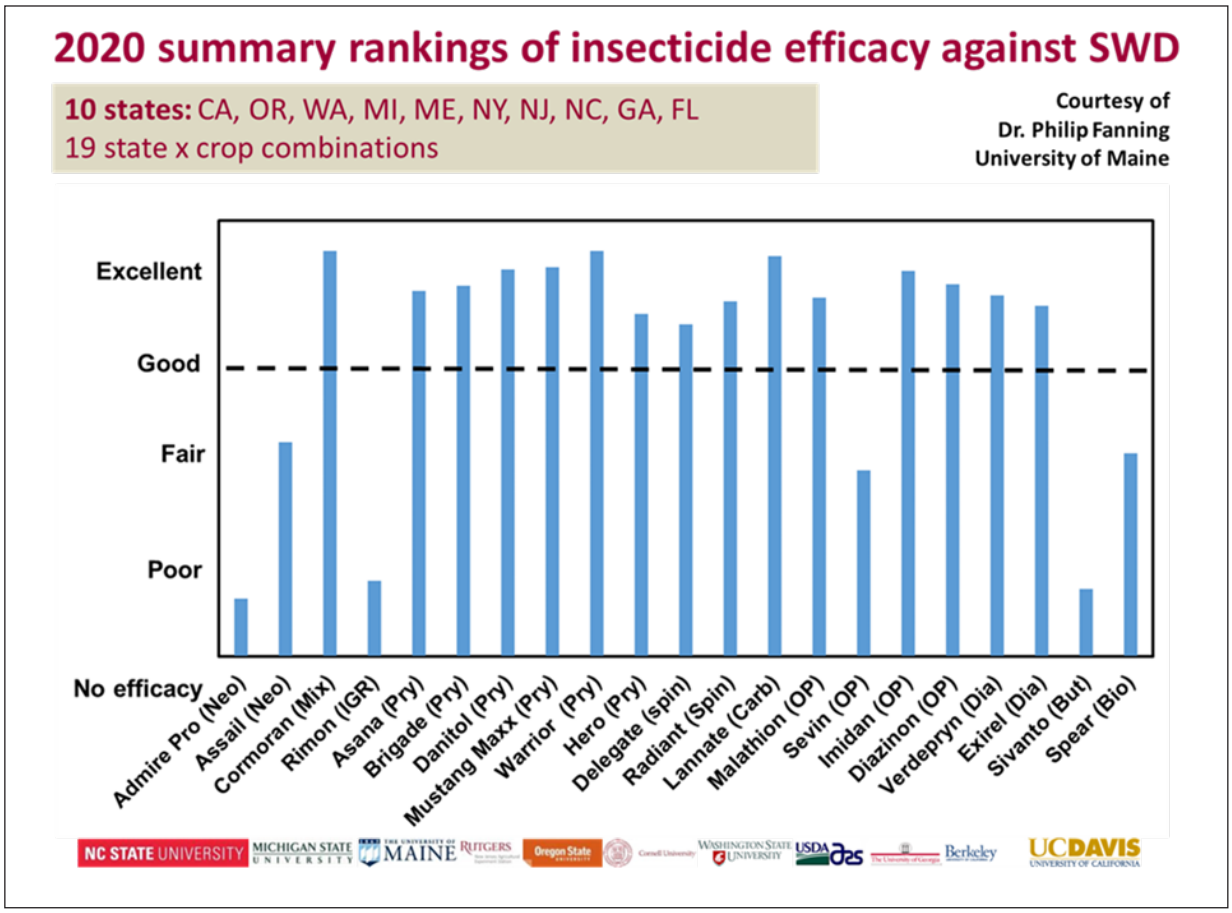
Spotted wing drosophila update from Dr. Jaime Pinero of the UMass Extension Fruit Team: SWD captures started to increase, yet I don't believe populations have reached damaging levels. If the fruit is susceptible, consider spraying an insecticide and add sugar to the tank mix to increase the effectiveness of the spray. The presence of sugar induces feeding, so SWD adults are more likely to ingest insecticide when sugar is present. See the table on the following page for insecticides for SWD. Entrust is the most effective OMRI-approved product for SWD.

Table 3. Sweetcorn pest trap captures for week ending July 7

Location	GDD[1] (base 50°F)	ECB NY	ECB IA	FAW	CEW	CEW Spray Interval
Western MA						
Deerfield	1036	0	0	1	3	*6 days*
Feeding Hills	1084	3	0	0	2	*6 days*
Granby	1049	0	0	0	0	*no spray*
Hatfield	1007	1	0	0	2.25	*6 days*
Whately	1066	3	1	0	2	*6 days*
Central MA						
Leominster	1001	3	0	0	0	*no spray*
North Grafton	913	7	0	0	5	*5 days*
Sutton		0	0	0	1	*no spray*
Spencer	965	6	0	0	0	*no spray*
Eastern MA						
Bolton	995	1	0	-	0	*no spray*
Concord	1011	0	0	0	2	*6 days*
Haverhill	1041	5	0	0	2	*6 days*
Ipswich	891	2	0	0	4	*5 days*
Littleton	-	7	0	0	0	*no spray*
Millis	-	1	0	-	1	*no spray*
Sharon	1030	0	0	-	1.5	*6 days*
Sherborn	1034	0	0	0	0	*no spray*
Seekonk	1150	0	0	1	0	*no spray*
Swansea		3	0	-	-	

- no numbers reported for this trap
N/A this site does not trap for this pest

[1]GDDs are reported from the nearest weather station to the trapping site



SCARAB BEETLES ARE ACTIVE

Japanese beetles have been flying for the past week or two. Oriental beetles and Asiatic garden beetles are also actively flying now and, though less damaging, may appear in vegetable fields as well. All species are feeding and starting to lay eggs.

Japanese beetle larvae. Photo: D. Cappaert.

There are four species of scarab beetles that are common in New England turf, fruit and vegetable crops, though none are native to the US. Japanese beetles are the most common and widely distributed but Oriental and Asiatic garden beetles are expanding their range and activity. European chafers are the least common.

JAPANESE BEETLE (*Popillia japonica*) adults are about half an inch long, with a metallic green head. The wings are shiny copper or bronze color, and there are a few tufts of white "fur" along the side of each wing when it is folded back over the body. The adults are very mobile and active in daylight, feeding on many different kinds of trees, as well as fruit and flower crops. Once feeding begins, they emit aggregation pheromones attracting other beetles to the same location. Fruit (like grapes) and ornamental plants (like zinnias and sunflowers) are preferred, but beetles can congregate in vegetables also. In vegetables, adults can cause silk clipping in corn, and leaf damage in sweet basil, greens, green beans, eggplant, asparagus, rhubarb, and peppers. Though numbers may be high, there is no need to treat unless actual feeding damage is significant. In corn, if there are more than two Japanese beetles per ear and corn is less than 50% pollinated, a pesticide application may be war-

Japanese beetles and feeding damage on kale. Photo: L. McKeag.

ranted to reduce clipping and ensure adequate pollination.

ASIATIC GARDEN BEETLES (*Maladera castanea* (Arrow)) are about half as long as a Japanese beetle adult, and somewhat more "plump" or domed in appearance. They are reddish-brown or copper-colored. They often are found near the roots of plants when one is weeding. Adults feed at night, so one may find damage without seeing the beetles. During the day they hide in the loose soil or mulch around the base of the plants. Scout with a flashlight at dusk or during the night, or sift through soil to find them. Larvae feed on beet, carrot, corn, lettuce, onion, Swiss chard, and strawberry. Adults feed on carrot, beet, parsnip, pepper, cabbage and turnip.

ORIENTAL BEETLES (*Anomala orientalis* (Waterhouse)) fly at night, but are very active during the day as well. The beetles are smaller than Japanese beetles, mottled tan or gray with black splotches. The pattern and color varies. The antennae are branched and are quite striking if you take a close look. Oriental beetles have a long flight period – through early August – and are very mobile. Adults show up in many crops but tend not to feed heavily in vegetable crop foliage. Grub damage is not commonly a problem in vegetable fields, though this is not well studied (grub damage may be worse in drought years and in weedy fields).

EUROPEAN CHAFERS (*Rhizotrogus majalis*), a fourth species which may also be found, are slightly larger than Japanese beetles and are a dull brown or tan colored. They are night fliers but can be seen in large numbers just at sunset, when they congregate in favorite trees (such as locust or willow). Adults are not foliage feeders and grubs are mostly a turf problem.

From top to bottom: Japanese Beetle, Asiatic Garden Beetle, Oriental Beetle, European Chafer.
Photos (top to bottom): UMass Veg, M. Reding & B. Anderson, S.B. Scheufele, Michigan State Extension

Life Cycles

The life cycle of the 4 scarab beetles we encounter in New England are similar, with minor variations. Most have a one-year life cycle, with adults emerging from the soil in early July in most of Massachusetts (later farther north) to feed and mate. The females burrow into the soil (often in or near wide expanses of grass or sod) to lay eggs which hatch into tiny grubs (cream-colored larvae, C-shaped, with brown heads) that feed on the roots of grasses and other plants (they especially like corn). Grubs molt twice by the middle of September, and continue feeding until the soils begin to cool down. In late fall the third instar grubs migrate downward through the soil profile, staying below the frost line throughout the winter. Occasionally, second instar grubs overwinter in the soil, in which case, it takes 2 years for them to reach adulthood and they continue to be a root feeding problem rather than a foliar feeding problem. In the spring as soils warm up, grubs move back into the root zone and resume feeding for about six weeks. By the middle of June, most grubs have completed their feeding requirements and pupate (still in the soil) for about a week before emerging as new adults.

Management

On turf, insecticide controls normally target young grubs just as they begin to emerge from eggs in the fall. In vegetables, managing the grub stage may not be feasible (or necessary) since the grubs are most likely feeding elsewhere. Vegetable growers could run into problems with grub damage if turf or sod is plowed under in fall or spring and followed by a spring vegetable crop. A fallow or very weedy field may generate a hefty population of scarab beetles the following year.

Insecticides may be needed to control adult beetles if numbers are high and damage is significant. The New England Vegetable Management Guide lists products for Japanese and/or Oriental beetles in basil and sweet corn. For controls

in a crop where these beetles are rarely a pest and therefore not mentioned in the Guide, check the label of commonly used broad spectrum synthetic pyrethroids, carbamates, and neonicotinoids (as foliar spray). Organic options include neem/azadiractin products and pyrethrin.

Biological and cultural control options do exist though are variably successful for scarab beetles. Occasionally, growers use traps to attract adult beetles, however, this may simply attract beetles into the field. Instead, it is advisable to place these traps in locations where adults may go to lay eggs such as in lawns or at field edges through early August. The female winsome fly (*Isocheta aldrichii*) is a natural enemy of adult Japanese beetles that parasitizes adults. Look for the distinct white eggs on the thorax of adult beetles. Up to 30% control of 3rd instar Japanese and Oriental beetle grubs has been achieved by the introduced parasitic group wasp *Tiphia vernalis*. This wasp, which was released over 10 years ago, has been found in New England parasitizing grubs in early spring and summer. Beneficial nematodes (*Heterorhabditis* sp.) are commercially available for use against white grub larvae. However, scarab beetle species vary in their susceptibility to infection.

- by R. Hazzard, adapted from Turf Management Update; Pat Vittum, Turf Entomologist, UMass; Beth Bishop, Michigan State Univ.; Michael Seagraves, Cornell Cooperative Extension; and Ann Hazelrigg, Univ. of Vermont. Updated by K. Campbell-Nelson, 2016.

SHORT-TERM SUMMER COVER CROPS

We've had a pretty dry summer so far, interspersed with rainstorms that can cause significant erosion in bare soils. Bare soil also leaves room for weeds going to seed. Shade produced by a thick cover crop in the summer can keep weed seedheads from forming. There are several good legume and non-legume cover crop choices for planting now and through July that grow rapidly in the summer heat. When planting mixtures in the summer, select equally vigorous crops (similar height and growth rate) so they will not compete and shade each other out. For example, Jean-Paul Cortens, a New York farmer, likes a mix of 50 lbs/A sunn hemp, 10 lbs/A Japanese millet, 5 lbs/A sunflower, and 50 lbs/A cowpea or field pea.

Legumes

Cowpea (*Vigna unguiculata*), also known as black-eyed or southern pea, is fast-growing with peak biomass often reached in 60 days. It also tolerates drought and heat. Cowpeas can fix up to 100 lbs N/A with biomass of 3000-4000 lbs/A. It breaks down rapidly after incorporation. Cowpeas also can be harvested in the immature pod stage as a fresh legume. *Drill at 40-50 lbs/A and broadcast at 70-100 lbs/A*.

Sunn Hemp (*Crotalaria juncea*): This tropical legume (not related to other hemps) has great potential in our humid, tropic-feeling summers. Sunn hemp can produce very high amounts of biomass (3-4 tons/A in MA). It is a high nitrogen-fixing legume and can contribute over 100 lbs N/A to a following crop. Sunn hemp grows very fast in the summer, reaching 6 feet or taller in 8 weeks. Allow sunn hemp to grow 1-3 feet tall, then mow it and let it regrow. If allowed to get too tall, the stems will become tough and fibrous and will not decompose rapidly. This crop is an excellent companion for sorghum sudangrass, which can also be mowed to keep it from getting too fibrous. Sunn hemp is a day length-sensitive crop; it will grow anytime during the summer, however it will not flower and go to seed until the days start getting shorter in very late summer. Seed is mostly sourced from Hawaii at this point and may be expensive, but the N contributions may be worth it! *Drill 20-30 lbs/A*.

A field of sunn hemp in Florida.
Photo: T. Jones

Crimson Clover (*Trifolium incarnatum*) is a beautiful cover crop that is a great choice for a short-term summer cover or perhaps seeded between plastic rows to reduce splash and erosion and suppress weeds. It is not typically considered an overwintering cover crop in Massachusetts, but in a cover crop research trial conducted by the UMass Extension Vegetable Program in 2016, it overwintered well on four MA farms. It is fairly resilient and tolerates well-drained soils, heat, drought, and low fertility soils. Shade tolerance makes this cover crop a good choice for mixes. Depending on coverage, it can fix 70-150 lbs N/A. *Drill 10-20 lbs/A, and broadcast at 12-24 lbs/A*.

Non Legumes

Sorghum Sudangrass (*Sorghum bicolor x S. sudanense*) Sorghum sudangrass is a cross between grain sorghum and sudangrass. It is a warm-season annual grass that grows well in hot conditions and produces a large amount of biomass. Its thick root system and high biomass make it useful for soil building. Sorghum sudangrass can reach 6-12 feet tall but should be mowed when it reaches 2-3 feet tall to prevent it from becoming fibrous and difficult to manage. Mowing also encourages root growth. Unmowed sorghum sudangrass will winterkill but the tough residue can be difficult to manage in the spring. Brown midrib types will decompose more quickly because they have less lignin. Expect 3-4 tons of biomass addition per acre in MA. Because it is a grass, to get the most growth you will need to add nitrogen fertilizer (40-80 lbs/A), which will be cycled on to the next crop. Sorghum sudangrass is very effective at suppressing weeds and has been shown to have allelopathic and biofumigant properties useful for nematode management. *Drill 35-40 lbs/A or 40-50 lbs/A broadcast.*

Phacelia (*Phacelia tanacetifolia*), also known as blue or purple tansy, is a good cover crop for use in rotation on vegetable farms because it is in a different plant family than most vegetable crops. This fast-growing cover crop is best to seed in mid-summer. While it does not have a deep taproot, phacelia is a wonderful soil aggregator in the top 2 inches. Beneficial insects including parasitoids, bees, and pollinators are attracted by the fuzzy blue/purple flowers. This cover crop will winterkill at 15°F. *Seed at 1lb/A drilled and 3 lb/A broadcast.*

Forage-Type Pearl Millet (*Pennisetum glaucum*) or **Japanese Millet** (*Echinochloa* spp.) have similar functions as a summer cover crops: they grow rapidly but are easier to manage than sorghum sudangrass. They also produce less biomass than sorghum sudangrass. Both millets grow about 4-6 feet tall and have similar seeding rates. They are well-adapted to sandy and/or infertile soils and do well in the summer heat. Forage types are better adapted for soil improvement than grain types. To get the most growth, you will need to add nitrogen fertilizer (40-80 lbs/A). Pearl millet has been shown to suppress some nematodes. Forage pearl millet can make a good mulch for late-summer plantings of no-till or strip-till crops. *Seed at 12-15 lbs/A drilled or 15-20 lbs/A broadcast*.

Buckwheat (*Fagopyrum esculentum*): If weed suppression is your main goal, buckwheat is a good choice. It can be sown as early as May 20, but will put on more growth if seeded in June. As a broadleaf plant, it covers the ground earlier than grass cover crops, and out-competes weeds. A good stand of buckwheat attracts beneficial insects, improves soil tilth, and produces more biomass than any other cover crop in the short time it grows, but doesn't do well if the plow layer is compacted. It scavenges phosphorus from soil and makes it available to subsequent crops. Buckwheat does well even in low nitrogen or low phosphorous soils, without additional fertilizer. Buckwheat decomposes quickly after incorporation. Mow or incorporate when the planting begins flowering to avoid seed production and volunteers. *Drill at 50 lbs/A or broadcast at 70 lbs/A.*

A field of buckwheat.

Additional Information

- Summer Soil Improving Crops for Vegetable Rotations, Gordon Johnson, Extension Vegetable and Fruit Specialist, University of Delaware.
- Cover Crop Guide for New York Vegetable Growers. From Cornell Cooperative Extension. This site includes cover crop profiles as well as a cover crop decision tool, where you can get crop recommendations based on your management goal, planting time, and cover crop duration.
- Cover Crops: What a Difference a Few Weeks Makes! Results from Cornell Organic Cropping Systems Trials.
- Cover Crop Periodic Table

--UMass Extension Vegetable Program

KNOCK WEEDS OUT AT CRITICAL TIMES

--by Mark Schonbeck, Virginia Association for Biological Farming for eXtension March 23, 2010

The "control" part of mechanical weed control aims to remove weeds that threaten current or future production at the least possible cost in labor, fuel, machinery and potential harm to the soil. Trying to eliminate every weed on the farm would likely lead to red ink, and can defeat efforts to build healthy soil. Thus, the farmer must continually evaluate: do I need to kill the weeds in this crop now? When are the critical times for weed control during the course of the season? For the organic farmer, critical times for weed control are those points at which cultivation or other measures will most effectively protect current and future crops from the adverse effects of weeds. Critical times include:

- When the crop is planted
- When flushes of weed seedlings are just emerging
- During the crop's minimum weed-free period
- When perennial weed reserves reach their minimum
- Before weeds form viable seed or vegetative propagules

Start with a Clean Seedbed. Weeds that emerge before or with the crop have a greater impact on crop yield than later-emerging weeds. Planting into a clean, weed-free field is essential. Remember that an apparently clean seedbed prepared just a few days before the vegetable is planted may have millions of germinating weed seedlings per acre that have not yet visibly emerged. Whenever possible, plant immediately after the final step in preparing the ground – whether that step is harrowing, rototilling, incorporating amendments, shaping the beds, or strip-tilling the crop rows.

For many crops, blind cultivation can be used to keep the seedbed clean until the crop is up. Larger-seeded vegetables can be rotary-hoed to give them a head start. Weed seedlings that beat slow-germinating crops like carrot to the punch can be removed by flaming. Some farmers time this operation by covering a small patch with a pane of glass. When the crop first emerges under the glass, the field is flame-weeded. The rest of the crop then emerges a day or two later, in a clean field.

Get the Weeds When They are Small. The smaller the weed, the easier it is to kill through light cultivation or flame weeding. Early in the growing season when large "flushes" of weeds often emerge, many farmers do a very shallow cultivation when weeds are in the "white thread" stage or are just emerging (long before the weeds begin to compete with the crop), rather than waiting until the field is visibly weedy. Shallow cultivation often pays because it:

- Minimizes damage to soil structure and soil life
- Minimizes light-stimulated germination of additional weeds
- Requires less fuel and less effort
- Can kill millions of newly emerging weeds per acre

A basket weeder is a great way to kill weeds while they're in the "white thread" stage. Photo: S B Scheufele.

This approach may be especially advantageous during early stages of crop establishment and growth. Cultivate before weeds get more than an inch tall. Some weeds develop an incredible ability to re-root and survive light cultivation once they pass this stage. Weeds two to three inches tall require more vigorous cultivation, which consumes more fuel, disrupts soil structure, and stimulates additional weed seed germination. One possible disadvantage to this "proactive" approach to timely cultivation is that it can result in multiple passes through the field to keep removing small weeds until the crop is established.

Avoiding Over-cultivation: Minimum versus Critical Weed-Free Periods. Weed scientists and farmers have a couple ways of estimating when cultivation is most important for keeping weeds from hurting the current crop. One is to ask how

long after crop planting can weeds be allowed to grow before they must be removed (the "maximum weed-infested period"). Another is to ask how long the crop must be kept clean before later-emerging weeds can be allowed to remain (the "minimum weed-free period"). A third is to determine the stage(s) of development in which the presence of weeds is most likely to hurt yields (the "critical period of weed competition" or "critical period for weed control").

Assuming that the crop is planted into a clean seedbed, germinating crops and weeds start their "race" at the same time. Weeds that germinate with the crop usually do not affect the crop's growth until two or three weeks after emergence – when they first become large enough to begin competing for moisture and nutrients. This initial "grace period" during which weeds can grow without reducing the crop's yield potential is the **maximum weed-infested period**. The farmer needs to cultivate or otherwise control weeds before the end of this period.

Weeds that emerge with or shortly after the crop have the greatest potential for causing economic damage if allowed to grow unchecked. Later emerging weeds have less effect, and those that emerge after a certain point in time no longer affect yield. This point is the **minimum weed-free period**.

The interval from the end of the maximum weed-infested period until the end of the minimum weed free period defines the **critical period for weed control for the crop**. Since the crop can be adversely affected either by early-emerging weeds allowed to persist into this period, or by weeds emerging during this period and allowed to grow, the weed control strategy should focus on keeping the crop clean through this time. If cultivation is limited to one or two passes, it must be strategically scheduled within this period, and implements designed to be effective against the largest weeds present must be used. Possible advantages to this approach include:

- Less labor and machinery time is expended on weed control
- Fewer operations are easier to schedule
- Less frequent disturbance of the soil surface can mean less surface crusting and erosion
- Larger weeds leave more residue that can further protect soil surface from degradation

However, this approach can be risky especially in vegetable crops that are not highly competitive or have long critical periods for weed control (e.g., carrot), or that need to be quite clean at harvest (e.g., salad mix). When cultivation is delayed until the beginning of the critical period for weed competition, the farmer depends on favorable conditions for effective cultivation at that time. If an untimely rain falls, the additional delay will likely result in a significant yield loss. Therefore, most Extension agents and consultants advise organic vegetable growers to "get weeds while they are small," especially early in crop development.

Keep the Crop Clean Through its Minimum Weed-Free Period. Once the early flushes of weeds have been knocked out, continue monitoring and controlling later-emerging weeds until the crop has passed through its minimum weed-free period. For vigorous vegetables this period is generally the first one-third of the crop's growing season, or four to six weeks for crops like tomato, squash, cucumber, snap bean, and transplanted brassicas; and perhaps a little longer for eggplant and pepper. Less vigorous crops like onion or carrot may need weed-free conditions for at least the first half of their life cycle, perhaps eight weeks or more.

How "clean" is clean enough during this period? Crops differ in their inherent weed tolerance even during the minimum weed-free period. Slow-growing, weed-sensitive vegetables like parsley, direct-sown onion or carrot can suffer if weeds are allowed to reach the two-leaf stage before cultivation. Thus, it may pay to "cultivate early and often," knocking weeds out in the white-thread stage until the crop is well established. In vigorous crops like beans, sweet corn, or potatoes, one early cultivation and a second pass to remove later-emerging weeds at the two-leaf stage or even a little larger, may be sufficient.

While the crop is still small, those weeds emerging closest to crop plants compete most severely. Therefore, cultivation must effectively remove within-row weeds, as well as weeds between rows. Timing is critical for mechanical within-row weeding, which works only when the weeds are tiny and the crop is sufficiently large that it can withstand the effects of light cultivation. Later in the minimum weed-free period, the growing crop begins to shade out emerging within-row weeds, while weeds emerging between rows can still grow unimpeded and pose a threat. At this point, some vegetables can be cultivated with a between-row implement adjusted to throw some earth into the row to bury and thereby hinder small within-row weeds. This works well for potato, corn, tomato, broccoli, and other tall vegetables that tolerate hilling-

up, but of course not for lettuce, spinach, and other vegetables whose edible parts form close to the ground.

Hit Perennial Weeds When Their Reserves are Low. Invasive or wandering perennials like quack grass, nutsedge and Canada thistle that reproduce through a propagating network of rhizomes, roots, stolons, tubers or bulbs are often the most difficult to manage. An initial tillage pass deep enough to chop up these structures will effectively propagate the weed, as each fragment soon regenerates a new plant. However, these plants are weaker than the larger plants growing from undisturbed underground structures. During the first three or four weeks after fragmentation, the pieces of root or rhizome draw down their underground reserves in order to regenerate shoot growth. When the growing weeds each have several open leaves, they begin rebuilding reserves through photosynthesis. Soon thereafter, they can begin to form new rhizomes, bulbs, tubers, or other vegetative propagules.

Additional tillage, or even simply removing top growth, whenever the weeds reach the three to four leaf stage can be quite effective in further weakening invasive perennial weeds. The farmer may need to do this several times at three or four week intervals to knock out a serious infestation. Planting buckwheat or other "smothering" cover crops at high seeding rates immediately after tillage intensifies pressure on the weed, and can get the job done faster with fewer tillage passes. When wandering perennial weeds emerge in a vegetable crop, cultivate to sever top growth whenever the weeds reach this critical three to four leaf stage. Sharp sweeps or knives set to work just below the soil surface will do the job.

News

Some Pesticides Containing Neonicotinoids Became Restricted Use in MA as of July 1, 2022

On July 1, pesticides containing neonicotinoids that are labeled for turf, trees, shrubs, golf courses, and ornamentals became state restricted use in Massachusetts. This includes any product that has the above use patterns on the label, even if the product is also labeled for vegetable or fruit use. Products containing neonicotinoids that are labeled for agricultural use only (aka labeled for use on food crops only) remain general use. You do not need a pesticide license in order to apply general use products, but you do need a license to apply restricted use products. As of July 1, in order to apply these newly restricted use products, you have to have a Commercial Certification Pesticide License. You can also apply these materials without a license if you are working under the direct supervision of someone with a Commercial Certification.

Click here for a complete list of products that became restricted use as of July 1.

Click here to begin the process of obtaining a pesticide license. (A helpful guide to the ePLACE Portal is available here). The UMass Pesticide Education Program provides education around pesticide safety and classes to prepare individuals for pesticide license exams.

MassDEP's GAP III Energy Grant Program Expanded to Include New Sectors

Nonprofit agricultural/food distribution and small food distribution and processing businesses, among other categories, may now apply for a GAP III Energy Grant. Eligible projects include energy efficiency projects such as HVAC upgrades and clean energy projects such as solar photovoltaic and battery storage systems.

For more examples and for full eligibility and application information, click here. The grant application deadline for non-profits and small businesses is Friday, July 29, 2022.

MA Farm Energy Program (MFEP) - Energy Audits

Remember, MDAR's Farm Energy Program has funds to help farms cover audits, energy efficient projects, and select renewable energy projects. We are still providing these services remotely.

You will need a technical assessment to file an energy grant application whether with MDAR or USDA. Start planning now. If you wait too long you may not be able to have one scheduled in time! MFEP pays 75% of the technical assessment, first come, first served. Our MFEP is providing tele-assessments during this trying time.

Contact MFEP now for more information through the Center for EcoTechnology (CET), our partner carrying out the MFEP: 413-727-3090, info@massfarmenergy.com, or visit www.massfarmenergy.com, submit a Request Form, and then you will be contacted.

Events

Save the Date -- UMass Research Farm Field Day

When: Tuesday, August 2, 2022, 4-6:30pm, followed by light refreshments

Where: UMass Crop & Livestock Research & Education Farm, 89 River Rd., South Deerfield, MA

Registration: Event is free, but registration will be required

Join us for a tour of our current research projects at the farm. Topics will include downy mildew resistance in basil and cucumbers, reducing pesticide use by improving spray coverage, bio- and OMRI-fungicides to control diseases of vegetables, and more. Registration information and more details coming soon!

Twilight Meeting at Harvest Farm

When: Wednesday, August 24, 2022, 4-6pm

Where: Harvest Farm, 125 Long Plain Rd., South Deerfield, MA 01373

Harvest Farm in Whately/South Deerfield will host us for a twilight meeting covering several post-harvest topics, including the vacuum cooler Harvest Farm recently purchased with a MA Food Security Infrastructure Grant. More information coming soon!

Save the Date - Pollinator Habitat Workshop

When: Thursday, Sept. 22, late afternoon/early evening (exact time TBA)

Where: Just Roots Farm, 34 Glenbrook Dr, Greenfield, MA 01301

Come learn about the nuts and bolts of installing pollinator habitat on your farm, including where to find funding and who to contact for assistance. Includes a short presentation and a meet-and-greet with local service providers. Event is hosted in collaboration with CISA, NOFA, Greening Greenfield and Just Roots.

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Vegetable Notes. Genevieve Higgins, Lisa McKeag, Susan Scheufele, Hannah Whitehead co-editors. All photos in this publication are credited to the UMass Extension Vegetable Program unless otherwise noted.