Black cutworm larvae feed on newly emerged vegetable crops and often clip the young plants at or below the soil line each night. Scout your fields!

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If you're growing beets, spinach, or swiss chard and the leaves look as though something is tunneling inside of them, then you're seeing signs of Beet (or Spinach) Leafminer.

PAGE 4

Are your plants failing to thrive? Dig up a few plants and look at the roots. A lack of root branching or oddly clustered in some areas may indicate pendimethalin injury.

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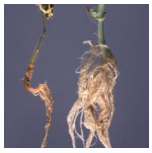

Local samples of zucchini and other vine crops had root systems that were confirmed by Cornell AgriTech to be positive for Fusarium infection.

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VEGEdge

YOUR TRUSTED SOURCE FOR RESEARCH-BASED KNOWLEDGE

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Photo: J. Kikkert

Cornell Cooperative Extension
Cornell Vegetable Program

PEST ALERT: Black Cutworms and True Armyworms are Active Now

Julie Kikkert, CCE Cornell Vegetable Program, and Brian Nault, Cornell

With the late planting season, there are many fields of young seedlings in our region that are highly susceptible to cutworm feeding. We have seen or heard of **cutworms feeding in sweet corn, field corn, peas, and table beets** over the past week or two. Additionally, common "true" armyworm moths are currently being caught in traps and larvae have been found in small grains this past week (NYS IPM Weekly Field Crops Pest Report, June 14, 2019). Here is what you need to know:

Black Cutworm (*Agrotis ipsilon*):

The larvae feed on newly emerged vegetable crops and often clip many young plants at or below the soil line each night. Crops grown from seed are more prone to damage than transplants. According to R. Groves, Univ. of Wisconsin-Madison, susceptible

Black cutworms feeding on beets. *Photo: J. Kikkert, CCE CVP*

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VegEdge newsletter is exclusively for enrollees in the Cornell Vegetable Program, a Cornell Cooperative Extension partnership between Cornell University and CCE Associations in 14 counties.

The newsletter is a service to our enrollees and is intended for educational purposes, strengthening the relationship between our enrollees, the Cornell Vegetable Program team, and Cornell University.

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Help us serve you better by telling us what you think. Email us at *cce-cvp@cornell.edu* or write to us at Cornell Vegetable Program, 480 North Main Street, Canandaigua, NY 14424.

Contents

The next issue of VegEdge newsletter will be produced June 26, 2019.

Late Blight Risk – Severity Value Accumulations

John Gibbons, CCE Cornell Vegetable Program

Late blight severity values will have reached the 18 severity value point at most locations through the forecast period. Once the 18 severity value threshold is reached or forecast apply a fungicide, as soon as you can to any potato fields or tomato fields with plants larger than four inches tall. Once you've applied your first fungicide, use Simcast or early blight P-Days to help schedule your fungicide applications for the remainder of the season. This can be found on NEWA at the following address: http://newa.cornell.edu/index.php?page=potato-diseases We will be switching to the Simcast next week for the remainder of the season.

There have been no new light blight reports nationally. The only positive sites remain in north Florida. You can monitor this by going to the late blight website: https://usablight.org/?q=map

Late Blight Severity Values* 6/18/2019

Location	Total	Forecast 6/19-6/21	Location	Total	Forecast 6/19-6/21
Albion	9	7	Kendall	10	10
Arkport	15	9	Knowlesville	14	7
Baldwinsville	29	8	Lodi	NA	NA
Bergen	14	7	Lyndonville	13	9
Buffalo	38	8	Medina	20	8
Burt	12	8	Niagara Falls	36	8
Butler	20	7	Penn Yan	32	8
Ceres	25	10	Rochester	30	8
Fairville	8	7	Sodus	17	7
Farmington	21	7	Versailles	32	6
Fulton	31	6	Wellsville	58	11
Geneva	12	7	Williamson	9	7

* Severity value accumulations start 5/15/2019

crops include beets, carrots, cucumber, leafy greens, melons, onions, peas, potato, pumpkin, snap beans, squash, and sweet corn.

Scout fields near any woods or weedy hedgerows that border fields. Look closely for plants that have been sheared off at ground level or areas where plants are not emerging well. There may or may not be cut leaves laying nearby. Cutworms sever young plants near the soil line and pull the plant into the ground as they feed. Severely infested fields this past week had beautiful stands of beets that seemed to disappear overnight! If you dig up the cut off plants, you will likely find cutworms in the soil near the base of the plant or just underground. You may also see holes where the worms come in and out of the soil. The larvae are nocturnal feeders, however, on rainy days you may see cutworms coming out of their holes and feeding during the day. The larvae curl into a characteristic C-shape when disturbed.

Black cutworm moths fly up from the south and lay their eggs on weeds near field borders. The larvae then crawl to the crop field. Thus, damage can typically be seen near field borders. The best control is to apply an insecticide along the edges of the field where the caterpillars are feeding. It is usually not worthwhile spraying the entire field; however, if cutworm damage is detected deeper within fields, then the entire field could be treated. In a perfect world, insecticides would be applied in late evening or at night so that the chemical would directly contact the caterpillars.

Economic treatment thresholds for black cutworms have been developed for the following crops (Univ. of Wisconsin):

- Snap bean= 2 larvae/row foot
- Potatoes= 4 larvae/row foot
- Sweet Corn= >5% of plants damaged
- Leafy greens= <3% of the stand affected

Several pyrethroid products are labelled in New York for the control of cutworms. Please check the label for your specific crop. For organically grown crops, our current best thinking is that a mixture of azadirachtin and pyrethrin provides the best chance of control. Contacting the caterpillars with the spray might improve efficacy, so spraying in the late evening or night might be beneficial. While Bt's (*Bacillus thuringiensis*) are labeled, the caterpillars must ingest the product and it may not be very effective on large caterpillars.

For more information on black cutworm biology and management, see: http://labs.russell.wisc.edu/vegento/pests/black-cutworm/

Black cutworm larva. *Photo: J. Kikkert, CCE CVP*

True armyworm larva. Note the two orange and white bordered stripes on the side. *Picture Courtesy of: Frank Peairs, Colorado State University, Bugwood.org*

Common "True" Armyworm (*Pseudaletia unipuncta*):
(Information from the NYS IPM program, edited by J. Kikkert)

These insects do not overwinter in New York, rather the moths migrate from the south in the spring. The migrations are sporadic and often difficult to predict from year to year. True armyworms prefer to feed on plants in the grass family such as corn, small grains, pastures and lawns. However, when populations are large and their food is limited, they will feed on legumes and other plants. This was the case with huge populations in 2001 and 2008, with the caterpillars were seen "marching" from field to field and sometimes across roads.

Armyworm moths lay their eggs on weeds or grasses along field margins, corn leaves, or small grains. Larvae hatch about a week later and develop for about three weeks. They feed mostly at night. True armyworm larvae range in size from 1/8 inch to 1.5 inches long. Small larvae appear smooth, cylindrical, and are pale green to brownish. Mature larvae are smooth and marked with two orange and white-bordered strips on each side. The larvae spend their time above ground on foliage, unlike cutworms which live under the ground.

Larvae typically feed on leaves, stripping them down to the midrib. Feeding is generally the worst on field edges or in areas where grassy weeds are prevalent. Many pyrethroids are labeled for control. Caterpillars over 3/4 to 1-1/4 inches long are getting ready to pupate and an insecticide application is not likely to provide much benefit.

Recommended economic thresholds for corn:

- seedling: 10 percent or more plants show damage and larvae are still present.
- whorl-stage: apply an insecticide when there are three or more larvae per plant.

More information of true armyworms can be found at the following link:
http://blogs.cornell.edu/ipmwpr/true-armyworm-aka-common-armyworm-pseudaletia-unipuncta-in-field-corn/

How to Beet Leafminers

Caitlin Vore, CCE Cornell Vegetable Program

Summer is slowly crawling to a start, but what's crawling inside of your Swiss Chard? If you're growing beets, swiss chard, or spinach and the leaves begin to look as though something is tunneling inside of them, then you're seeing tell-tale signs of the Beet (or Spinach) Leafminer. As adults, these leafminers are small grayish-black flies with light yellow markings. They emerge from the soil in late May / early June, and begin seeking the perfect spot for the next generation to get started – beet, swiss chard, or spinach leaves.

The white, cylindrical eggs are laid in clusters on the undersides of leaves. Over the course of the next few weeks, the leafminer larvae hatch and burrow (or mine) their way in between the layers of a leaf and there they begin chowing down. Unless you're scouting your crops on a regular basis, the first sign of an infestation you may see are winding, opaque tunnels across the leaves. As the larvae mature, their appetites increase, and so does the damage. Extensive damage looks like large blotches of water soaked blisters that eventually turn brown. Ultimately the photosynthetic area of the plant decreases, and a window of opportunity is opened for diseases like Cercospora Leaf Spot, Phoma Leaf Spot, or Bacterial Leaf Spot. In as little as 1-2 weeks, the larvae are large enough to chew an exit out of the leaf and drop to the ground, continuing the life-cycle. It's typical to see 3-4 generations in a year.

Clusters of white, cylindrical Beet Leafminer eggs on the underside of a chard leaf. *Photo: C. Vore, CCE CVP*

For the most part, an infested plant *can* grow out of the damage, leaving only unappetizing looking leaves behind. For beet growers this may be acceptable, as infestations do not typically reduce yields. Ultimately it will depend on your markets. If you plan to sell your beets without their tops – no problem. But if you plan to grow spinach, swiss chard, or sell your beets *with* their tops, the damaged foliage may be severe enough to reduce the marketability of the edible greens.

Large opaque blister-like feeding damage from Beet Leafminer larvae. *Photo: C. Vore, CCE CVP*

How to Beet 'Em!

Prevention – Frequent scouting is the best way to prevent a leafminer problem from becoming established. Scouting should begin when the flies begin emerging from the soil – late May, early June. Check the undersides of the leaves for the white, cylindrical egg masses and begin treatment as soon as you spot them.

Crop Rotation – Adult flies emerge from the soil where infested crops were previously located. So, if you know you have a history of spinach or beet leafminer, and have the space to allow for crop rotation, rotating away from spinach, swiss chard, or beets for 2-3 years can help break the cycle.

Weed Management - Unfortunately, these leafminers *also* have a back-up plan if they can't find those crops. They've also been known to lay eggs and feed on lamb's quarter, pigweed, plantain, and chickweed, so staying on top of your weed management is one further step you can take to beat them back.

Exclusion – If you're able to rotate away, great! You should also consider protecting your crops with row cover. As their name implies, flies…fly. Until you've broken the cycle, there's a good chance they'll emerge in the Spring and find their way to your crops so exclude them from the get-go. **Note:** Row cover will only help if placed over plants *before* the adults are active.

Treatment –Timing is critical if you choose to spray. Once the larvae have hatched and mined their way into the leaf, pesticide sprays cannot easily reach them. So, catch them early by scouting, and take care to cover the *lower* leaf surfaces.

The 2019 Cornell Commercial Vegetable Guidelines recommends Entrust SC (spinosad) for **Beet** crops. For **Spinach**, a preventative schedule is suggested. Begin applications when spinach has two true leaves, and repeat every seven days. Conventional control options include Agri-Mek, Coragen, Trigard, and Radaiant SC, Organic control options include Entrust SC. Keep in mind that some products are labeled for Swiss Chard, but not for spinach or beets.

CROP INSIGHTS

CUCURBITS
Damping off in wet soils and some cutworm damage. Large, tender transplants have shown damage following transplanting due to winds (foliage) and sunburn (stems laying on plastic). – *EB*

LETTUCE & CHARD
Tarnished plant bugs are here. – *EB*

ONIONS
The summer solstice is this Friday, the longest day of the year, which triggers bulbing in onions. The question is, will the late planted fields make it? I sure hope so! Earliest planted early varieties of transplants started bulbing this week. Direct seeded fields range from 1-leaf to 5-leaf with many fields in the 3-4 leaf stage. Within the next couple of weeks will be the last opportunity to apply post-emergent herbicides Chateau (maximum 6-leaf) and Buctril (maximum 5-leaf) to direct seeded onion. Goal 2XL and Goaltender may be applied until 45 days pre-harvest (=mid-July for an end of August harvest) up to the maximum seasonal use rates (Goal 2XL: 2 pts; Goaltender: 1 pt). This is also the time of year that fungicide programs for Botrytis leaf blight (BLB) tend to begin. Despite seemingly great conditions for BLB (cool and wet), we have not seen too much BLB yet with only a couple of fields approaching the spray threshold of 1.0 BLB lesion per leaf and Bravo keeping the disease well in check in transplants. We did see our first onion thrips (OT) of the year this week, often only 1-2 insects per 40 plants. Areas where OT are known to build first in the season should be scouted at this time.

This **Thursday, June 20th will be the Oswego Onion Twilight Meeting**, which also happens to be on the only day of the week when it is supposed to rain with the highest chance of rain during the twilight meeting (4:30 pm to 6:45 pm). We will have lots of new information to present indoors in dry conditions. The trial tour includes several pre-emergent herbicide treatments and several post-emergent treatments that were applied last Friday to 1-leaf onions with 2-3" marsh yellowcress. We will highlight results from trial in dry conditions, and then do a quick trial tour in the rain for those who are interested – bring raingear! – *CH*

PEPPERS
Aphids are problematic in several areas. Frequently they are an issue noticed a week or two after transplant of peppers held long in trays. Aphids can be difficult in peppers, well worth a scout. Check carefully deep in the growing point, and under older leaves. Aphid feeding can cause leaf distortion, too. – *EB*

POTATOES
Potato planting is finishing up across the area. Hilling operations are starting in early planted fields. **Colorado potato beetles** (CPB) remain active on potato volunteers this week. Egg laying is also increasing as temperatures warm. Larvae should be appearing soon. **Leafhoppers** were seen in one field this week. In furrow insecticides appear to be managing this pest for now. Monitor your fields for CPB adults and larvae and leafhoppers to determine when you may need a foliar spray to control. Leafhoppers need to be controlled as soon as damage is seen (Hopper burn) or before if possible. It appears as a browning on the margins of leaves and can resemble nutrient deficiency. Monitor 10 sites per field. The threshold to treat for this pest is when more than one adult is found per sweep with an insect net or more than 15 nymphs are found on 50 leaves. – *JG*

PROCESSING CROPS
Table beet and sweet corn growers specifically take note of the cutworm article on the cover. Insecticides that are labeled for cutworms and armyworms in table beets include Sniper LFR (bifentrin), Mustang Maxx (zeta-cypermethrin), Hero (bifenthrin plus zeta-cypermethrin). Sweet corn growers have some additional options, including Warrior (*lambda-cyhalothrin*). Warrior is NOT labeled on table beets. For organic growers, the best options are azadirachtin and pyrethrin. Azera is a premix of both active ingredients. Make sure to check product labels that both the crop of interest and cutworms are listed. Potato leaf hoppers are active in the state and organic snap bean growers should be managing these pests. Keep up with weed management with timely cultivations and/or herbicide applications as appropriate. – *JK*

SWEET CORN & TOMATOES
The CEW flights past peak in Erie and Niagara counties. However, very little corn had reached tassle stage during the main flight. CEW is a bit of a generalist and will also attack tomatoes. It would be a good idea to scout both crops for larvae in the next week or two. – *EB*

Downy Mildew in Basil

Robert Hadad, CCE Cornell Vegetable Program

With the weather we have had, humid conditions has made the environment right for the spread of basil downy mildew. Back in January, Dr. Meg McGrath, Cornell Plant Pathologist in Long Island, put together an extensive article on the subject. Here are some of the important excerpts from that article. The full article, EXPECT AND PREPARE FOR DOWNY MILDEW IN BASIL, can be found http://vegetablemdonline.ppath.cornell.edu/NewsArticles/Basil%20Downy%20Mildew-VegMD-McGrath-2019.pdf

The first step in preparing for basil downy mildew is learning the symptoms. Observing spores on the underside of leaves is key to diagnosis. There are other causes of leaf yellowing in basil. Spores are produced during the dark night period, therefore early morning is the best time to inspect basil for downy mildew. Leaves with yellowing resembling downy mildew but lacking spores can be placed upside down on wet paper towel in a closed plastic bag in dark for a day to encourage the pathogen if present to produce spores. Photographs are posted at: http://blogs.cornell.edu/livegpath/gallery/basil/downy-mildew/

Management

Using seed not infested with the basil downy mildew pathogen, selecting a less susceptible variety, and applying fungicides are the primary management practices for downy mildew. Pathogen-free seed is most important for plantings not expected to be exposed to wind dispersed spores, such as greenhouse crops when too cold outdoors for basil to survive.

Minimizing leaf wetness and reducing humidity to obtain conditions unfavorable for disease development may suppress downy mildew, especially in greenhouses.

Seed Tests

Recent efforts to develop a seed test have resulted in a genetic-based procedure specifically for *Peronospora belbahrii* that is now being validated (suspected contaminated seeds are needed for this step, see information about submitting samples below). And Eurofins STA Laboratories in CO (http://www.eurofinsus.com/stalabs/products-services-seed-health.html) now tests basil seed for *Peronospora* spp. It is sufficient to test only at the genus level with this pathogen since it is the only species of *Peronospora* that would be associated with basil seed.

Basil downy mildew.
Photo: M. McGrath, Cornell

Seed Treatment

Seed companies (including High Mowing Organic Seeds) are starting to steam treat basil seed. It is not amenable to hot-water treatment because while in water the seed produces a gelatinous exudate.

Varieties

Good suppression of downy mildew can be obtained with new resistant varieties that started to be marketed in 2018. They are the fruition of several years of conventional breeding by breeders working separately on this goal. It can take many crosses to obtain a plant with resistance plus all the desired horticultural traits that are in a susceptible variety, which include for sweet basil large, smooth, dark green, downward cupped leaves with good classic sweet basil flavor. Devotion, Obsession, Passion, and Thunderstruck are the first resistant varieties released from the Rutgers University basil breeding program. They are marketed by VanDrunen Specialty Seeds.

Fungicides

To control downy mildew effectively with fungicides, it is considered necessary to start before first symptoms and to make applications frequently. Many of the fungicides currently labeled for this new disease, plus others not registered yet, have provided limited suppression in some fungicide evaluations, demonstrating the difficulty in controlling this disease, especially in a research setting with applications made with a backpack sprayer, and thus the importance of starting before disease onset.

Part of the challenge of controlling downy mildew is the need for blemish-free herbs when marketed as fresh sprigs. To determine when to initiate a fungicide program and also when it is warranted to consider harvesting early to avoid losses to downy mildew, growers should not only routinely check the on-line spreadsheet to determine when downy mildew is occurring on basil nearby, but also regularly inspect their crop for symptoms.

The cucurbit downy mildew forecasting web site (http://cdm.ipmpipe.org) might be useful for predicting when conditions are favorable for basil downy mildew since both pathogens likely have similar requirements for successful wind dispersal long distances (e.g. overcast skies) and subsequent infection (e.g. wet leaves or high humidity). Summer is not a time to forget about this disease: unlike most other downy mildew pathogens, e.g. the ones affecting lettuce and cruciferous crops, which stop developing in summer, the basil downy mildew pathogen seems to develop best under moderate to warm temperatures while also tolerating cool temperatures. Don't forget to report occurrence of downy mildew as soon as possible at the monitoring page or via email to mtm3@cornell.edu.

<u>Organic Fungicides</u>

Basil has been added to the list of herbs on the label for Cueva (10% copper octanoate). Downy mildew is in the list of foliar diseases controlled by this OMRI-listed product. Procidic (3.5% citric acid) is specifically labeled for

continued on next page

basil downy mildew. It is exempt from EPA registration under FIFRA and thus does not need to be registered in NY. It was reviewed and determined to be NOP compliant by Washington State Dept of Ag. Actinovate AG (active ingredient is *Streptomyces lydicus*), Double Nickel 55 (*Bacillus amyloliquefaciens*), MilStop (potassium bicarbonate), Regalia (extract of *Reynoutria sachalinensis*), Trilogy (neem oil), and OxiDate (hydrogen dioxide) are OMRI-listed fungicides labeled for use on herbs and for suppressing foliar diseases including downy mildew. MilStop, Regalia, and OxiDate are labeled for use outdoors and in greenhouses. The Actinovate, Cueva, Double Nickel, Procidic, and Trilogy labels do not have a statement prohibiting use in greenhouses. Double Nickel label has directions for greenhouse use for soil-borne pathogens. OxiDate has limited residual activity and thus if used should be combined with or followed by another product.

Conventional Fungicides for Field-Grown Basil

Ranman (cyazofamid; FRAC code 21), Revus (mandipropamid; FRAC 40), Quadris (azoxystrobin; FRAC 11), Armicarb (potassium bicarbonate), and phosphorous acid fungicides (FRAC 33) can be used in conventional production of basil, in addition to the fungicides listed above. Quadris is the only one of these that is not permitted to be used in a greenhouse. It can be applied 6-15 times depending on rate with no more than 2 consecutive applications. Ranman is the first product labeled with targeted activity for oomycetes, the group of pathogens that includes those causing downy mildews. Ranman can be applied 9 times with no more than 3 consecutive applications which must be followed by the same number of applications of other fungicides. Revus can be applied 4 times with no more than 2 consecutive applications.

There are several phosphorous acid (phosphanate) fungicides labeled for this disease with no use restrictions, including ProPhyt, Fosphite, Fungi-Phite, Rampart, pHorsepHite, and K-Phite. Quadris is labeled for use on basil but not specifically for downy mildew; it also has been shown to be effective for this downy mildew. In states like NY where the target disease is required to be specified on the label, Quadris cannot be used without an approved FIFRA 2(ee) recommendation, which the applicator must possess. These fungicides with targeted activity are prone to resistance development due to their single site mode of action and thus need to be used within a fungicide resistance management program.

Death of a Seedling: Beets and Carrots

Julie Kikkert, CCE Cornell Vegetable Program

The challenging planting conditions this season have left many seedlings in less than ideal conditions. Large swings in weather conditions can put a lot of stress on germinating seeds and seedlings. Beet and carrot seedlings have thin, fragile stems which make them susceptible to heat, wind and diseases while they are young. The most common disorders are listed below:

Heat Canker

High soil temperatures and direct sunlight can cause tissues to die at or near the soil surface as the stems heat up. Very small seedlings will collapse all together. Older plants may survive when only the outer layers of the stem are killed. However, the flow of nutrients from the foliage to the roots is inhibited causing a swelling above the canker (Figure 1). The plants then wilt and break off at the crown. Muck soils are most conducive to this injury. Damage may be more prevalent on the south or south-west side of stems.

Figure 1. Similar to beets and carrots, heat canker in *Eucalyptus* causes a constriction of the stem at the soil line. *Photo: Edward L. Barnard, Florida Department of Agriculture, Bugwood.org*

Wind Whipping

Wind blowing particles of soil can injure the stems of seedlings at the soil line. The damage is often similar to that seen with heat canker.

Seed Decay and Damping-off Disease Symptoms

Pythium spp. and *Rhizoctonia* spp. can infect seeds and seedlings of beets and carrots. *Aphanomyces cochlioides* and *Phoma betae* can also infect beets. Infected seeds may decay or seedlings may fail to emerge from the soil. Healthy seedlings that become infected after emergence may exhibit a water-soaked and necrotic area at or just below the soil line. The plants then wilt, and die causing the typical damping off symptoms (Figure 2).

Figure 2. Damping-off in beet seedlings, characteristic of both *Rhizoctonia solani* and *Pythium* spp. Note progression of disease up the stem. *Photo: Robert M. Harveson, University of Nebraska.* http://www.plantmanagementnetwork.org/elements/view.aspx?ID=3158

Wire-Stem Symptoms in Beets

(from Abawi, et al. Root Rot of Table Beets in New York State, 1986)

The stem and main root regions of 2- to 4-week-old infected seedlings that survive the post-emergence damping-off stage usually become partially or completely shriveled; giving them a thread-like appearance. The infected regions are brown to black. Seedlings with wire-stem symptoms may have normal branching fibrous root systems, or roots that are brown and at different stages of rotting. Severely infected plants are stunted and reddish-purple. If plants are stressed and the infection progresses, infected roots may rot off just below the soil surface, and result in plant death and a reduced stand. Factsheet with photos available at http://vegetablemdonline.ppath.cornell.edu/

Diagnosing Pendimethalin (Prowl) Herbicide Injury

Elizabeth Buck, CCE Cornell Vegetable Program

Prowl is a popular pre-emergent herbicide choice on vegetable farms. It does a very good job controlling annual grass weeds and meaningfully reduces the pressure of certain annual broadleaf species, which makes it a good tank mix partner.

Pendimethalin is a group 3 herbicide. Group 3 herbicides are growth inhibitors that essentially disrupt root formation and elongation by inhibiting the proper organization and division of cells. Pendimethalin has to "activated" which means it needs to get from the soil surface into a zone of soil where weed seeds are germinating, so it can effectively "act" upon them. Pendimethalin remains active in the soil for several weeks. Cool, but why does that matter? Because you have to know how pendimethalin works in order to understand why it happens and why it causes its specific injury symptoms.

Plants injured by pendimethalin most often fail to thrive. The first symptom many will notice in the spring is stunted plants that don't seem to do much. As time progresses, the aboveground portions may start to look like they have a nitrogen or phosphorous deficiency, or they may be prone to wilting under dry conditions. The plants may panic and try to set flowers and fruit far too early. These aboveground visual symptoms all point toward dysfunctional roots.

Dig up a few suspect plants, and be sure to go far enough from the stem to get a good root sample. Carefully pick or wash the soil away from the roots. It is important to preserve as many roots as possible.

A normal transplant will have white healthy roots extending out from the transplant plug and holding onto the field soil. They should have nice white tips and spaced out branch roots, with lots of root hairs.

A pendimethalin injured plant will not have vigorous roots. The root tips may be rounded or swollen, and the roots will be shortened. **There will be a lack of root branching, and the branching may be oddly clustered in some areas and strangely absent in others. This is the most characteristic diagnostic feature, and is called bottlebrushing.** Overall, you'll also find few fine root hairs. Yes, spotting these symptoms requires patience and careful attention to detail.

Shortened stubby roots with a lack of branching on some roots (top of photo) and bottle brushing (lower portion of photo). *Photo credit University of Missouri IPM*

Transplants with pendimethalin injury may show root injury near the upper portion of the root ball and have decent roots underneath. They may also have started trying to grow new, adventitious roots out of their stems. Direct seeded crops may emerge damaged and weak, and could have little root development. Small-seeded or shallowly sown crops may not emerge well.

Sometimes secondary diseases will attack the injured roots, leading to decay. Secondary decay is very easy spot as you'll notice brown or yellow or collapsed roots. Often times, I find that my eye is drawn more to the color of the roots than to their architecture and so I find it easy to miss pendimethalin injury when there is also disease occurring.

Remember how pendimethalin has to be washed into the soil to get into the zone where weed seed are germinating, so the emerging weed can come into direct contact with the herbicide and be taken up into the new tissue? Well, soil type and volume of water dictate how many far the pendimethalin will move into the top layer of the soil. Normally, the pendimethalin is in the top inch of soil. Some of our crop protection from pendimethalin is a called "depth protection", which literally means that the seed or transplant roots of the crop are located below the layer of pendimethalin in the soil.

Pendimethalin injury is not an every-year occurrence. I see more of it when we have had wet conditions that move the herbicide down into the crop root zone. The problem is worsened when the soil is cold and the plants aren't as able to metabolize the herbicide and therefore can't easily rid themselves of the active compound and outgrow the damage. Most often, I see injury when stressed transplants are put into cool ground and they are planted into raised plastic beds where Prowl was sprayed right over top of the bed. The herbicide will run off the plastic mulch with rain and down into the transplant holes, concentrating herbicide in the root zone. If the ground is saturated, remains saturated, and is cool, injury can happen in transplants. Any field operation that concentrates pendimethalin in the root zone is risky and can cause you trouble.

Take away messages:

1) Prowl injury can be hard to properly diagnose, you really have to examine the roots carefully.
2) Wet years, especially if cool, are higher risk
3) Applying Prowl over plastic is risky! I know it works and can be safely done. In my experience, and talking with colleagues, 1 in 4 or 5 years there can be a lot of trouble from applying pendimethalin over plastic. That's enough to make me hesitant to endorse the practice.
4) Your pendimethalin injured plants may struggle all year if they cannot quickly overcome the injury.

Fusarium Infection of Transplant Roots

Judson Reid, CCE Cornell Vegetable Program

The CVP delivered samples of zuchinni and other vine crops to the Chris Smart lab at Cornell AgriTech recently, where root systems were confirmed positive for Fusarium infection. Fusarium is a soil borne fungus, with multiple species and multiple races. There are several diseases caused by this group of fungi including Fusarium Wilt, Fusarium Crown Rot and Fusarium Foot Rot. There are also post-harvest disorders of cucurbit fruit also caused by Fusarium species.

Why did we see such an outbreak this spring? In the case of any plant disease we need the pathogen to be present under favorable conditions to infect a susceptible crop. Intensive vegetable production on small acreage with short rotations can raise background soil levels of a pathogen such as Fusarium to higher levels capable of causing wide spread infection. This fungus produces durable spores (called chlamydospores) which can overwinter. What makes Fusarium particularly challenging is that it can infect many of our cover crops can be hosts of the disease. There are many species of Fusarium so it is difficult to speak in generalities, but often legumes are more susceptible than grass or brassica cover crops. This emphasizes the benefits of small grains or corn in a vegetable crop rotation.

There are no effective fungicide options for controlling a soil borne Fusarium outbreak so we must rely on prevention:

- Deep tillage of crop residue will hasten breakdown.
- Long rotations (3-5 yrs) away from veg crops (particularly cucurbits and solanaceous) and legumes.
- Avoid root injuries which create infection sites. These include Striped Cucumber Beetle larvae feeding, excess fertilizer salts and misapplication of root-pruning herbicides (see Diagnosing Pendimethalin Herbicide Injury, pg 8).
- Integrate grass and brassica species as cover crops where possible.

NY Sweet Corn Trap Network Report, 6/18/19

Marion Zuefle, NYS IPM Program; http://sweetcorn.nysipm.cornell.edu

Twenty-two sites reporting this week. European corn borer (ECB)-E was caught at six sites and ECB-Z was caught at five sites. Nine sites caught corn earworm (CEW). Fall armyworm (FAW) and Western bean cutworm (WBC) were caught at one site each.

Several sites have accumulated degree days that would indicate peak spring ECB flight and some are nearing the treatment period. Scout your sweet corn for any signs of eggs, larvae or damage. When scouting focus on the emerging tassel. Separate the leaves and look down into the tassel for any signs of feeding, frass or larvae. The threshold for ECB, CEW and FAW is 15% infested plants at tassel emergence. To help you scout your fields please view the video titled How to Scout Fresh Market Sweet Corn. This video will show you how and when to scout sweet corn using the Sweet corn scouting form (pdf). If you need additional help in learning how to scout please contact me: Marion Zuefle at mez4@cornell.edu or 315-787-2379.

WNY Pheromone Trap Catches, 6/18/19

Location	ECB-E	ECB-Z	CEW	FAW	WBC	DD to Date
Batavia (Genesee)	0	0	3	0	0	582
Bellona (Yates)	NA	NA	NA	NA	NA	602
Eden (Erie)	NA	0	13	0	0	603
Farmington (Ontario)	6	0	0	0	0	611
Geneva (Ontario)	5	4	0	0	0	582
Hamlin (Monroe)	NA	NA	NA	NA	NA	531
Kennedy (Chautauqua)	NA	NA	NA	NA	NA	621
Lyndonville (Orleans)	0	0	13	0	0	523
Penn Yan (Yates)	0	0	3	0	0	587
Portville (Cattaraugus)	0	0	0	0	0	613
Ransomville (Niagara)	0	0	24	0	0	532
Seneca Castle (Ontario)	NA	5	0	0	0	538
Williamson (Wayne)	0	0	0	0	0	480

ECB - European Corn Borer
CEW - Corn Earworm
FAW - Fall Armyworm
WBC - Western Bean Cutworm
NA - not available
DD - Degree Day (mod. base 50F) accumulation

Average corn earworm catch and recommended spray interval

Per Day	Per Five Days	Per Week	Days Between Sprays
<0.2	<1.0	<1.4	No Spray (for CEW)
0.2-0.5	1.0-2.5	1.4-3.5	6 days
0.5-1.0	2.5-5.0	3.5-7.0	5 days
1-13	5-65	7-91	4 days
over 13	over 65	over 91	3 days

Add one day to the recommended spray interval if daily maximum temperatures are less than 80°F for the previous 2-3 days.

European corn borer (bivoltine) development estimated using a modified base 50F degree day calculation.

Development Stage	Accumulated Degree Days
First Generation	
First spring moths	374
First eggs	450
Peak spring moths	631
First generation treatment period	800-1000
Second Generation	
First summer moths	1400
First eggs	1450
First egg hatch	1550
Peak summer moths	1733
Second generation treatment period	1550-2100

from J.W. Apple, Department of Entomology, Univ. of Wisconsin-Madison

Upcoming Events

view all Cornell Vegetable Program upcoming events at CVP.CCE.CORNELL.EDU

Women in Agriculture Discussion Group: Maple and Agroforestry

June 24, 2019 (Monday) | 6:00 - 7:30 PM
Gabel's Maple Syrup, 5095 Kaiser Rd, Lawtons, NY 14091

Each monthly Women in Ag discussion group meeting will feature an established, innovative Farm-her leading the group on a tour of her operation and sharing her expertise on business management and production. Several guest speakers, as well as Cornell Vegetable Program staff, will be brought in to act as resource people for developing solutions to common production challenges. Participants are encouraged to attend multiple meetings to see varied farm-her operations.

The June 24 meeting will cover maple production and putting woodlots to work led by Sharon Bachman, CCE Erie County. The meeting will be hosted by Lynn Gabel (Gabel's Maple Syrup). Lynn will share her experience in event agritourism and marketing value-added products.

View the full Women in Ag discussion group schedule on our website at cvp.cce.cornell.edu. For more info, including the most recent meeting and speaker schedule, or to join the discussion group, contact Elizabeth Buck at 585-406-3419.

Vegetable Pest and Cultural Management Field Meetings for Auction Growers

July 3, 2019 (Wednesday) | 7:00 - 9:00 PM
Jonas Peachy farm, 5461 Rt 414, Romulus, NY 14541 (Seneca County)

July 9, 2019 (Tuesday) | 7:00 - 9:00 PM
Alan Nolt farm, 5000 Phelps Rd, Stanley, NY 14561 (Ontario County)

July 19, 2019 (Friday) | 7:00 - 9:00 PM
Noah Hoover farm, 3095 Himrod Rd, Himrod, NY 14842 (Yates County)

This course will demonstrate pest management in fresh market vegetables in both field and greenhouse (high tunnel) vegetables, primarily for those growing for wholesale auction. A hands-on demonstration of weed, insect and disease identification in vegetables including management options such as inter-row cover crops, grafting, and where appropriate, spray options will be used to educate growers. Judson Reid, Senior Extension Associate with the CCE Cornell Vegetable Program along with CCE staff will instruct participants and facilitate peer-based learning. Planned topics:

- Weed Control in Row Crop Vegetables – Why and How
- Tomato and Potato Disease Updates
- Cucurbits – Grafting for Vigor and Yield, Downy and Powdery Mildew Management, Insect Pest Management
- Food Safety News
- Q&A and other farm-specific crop observations

1.75 DEC recertification credits (categories 10, 1a, 23) and 1.25 (category 24) will be offered. FREE to attend! For more info, contact Judson Reid at 585-313-8912.

Women in Agriculture Discussion Group: Small Fruit & Veg Production plus Insect Control

July 15 2019 (Monday) | 6:30 - 8:30 PM
Thorpe's Organic Family Farm, 12866 Route 78, East Aurora, NY 14052

Each monthly Women in Ag discussion group meeting will feature an established, innovative Farm-her leading the group on a tour of her operation and sharing her expertise on business management and production. Several guest speakers, as well as Cornell Vegetable Program staff, will be brought in to act as resource people for developing solutions to common production challenges. Participants are encouraged to attend multiple meetings to see varied farm-her operations.

The July 15 meeting will cover small fruit and vegetable production plus insect control led by Elizabeth Buck, CCE Cornell Vegetable Program, and Abby Seaman, NYS IPM Program. The meeting will be hosted by Gayle and Naomi Thorpe (Thorpe's Organic Family Farm). Gayle and Naomi will share their experiences managing a diversified organic farming operation and family farm transitions.

View the full Women in Ag discussion group schedule on our website at cvp.cce.cornell.edu. For more info, including the most recent meeting and speaker schedule, or to join the discussion group, contact Elizabeth Buck at 585-406-3419.

Weather Charts

John Gibbons, CCE Cornell Vegetable Program

Weekly Weather Summary: 6/11 - 6/17/19

Location**	Rainfall (inch)		Temp (°F)	
	Week	Month June	Max	Min
Albion	0.23	1.91	79	48
Arkport	1.00	2.42	75	45
Bergen	1.01	2.27	78	43
Brocton	1.17	4.08	71	50
Buffalo*	1.65	3.52	76	48
Burt	0.37	1.98	72	46
Ceres	1.19	3.53	74	41
Elba	0.77	2.74	77	45
Fairville	0.76	1.79	75	43
Farmington	0.61	1.77	77	43
Fulton*	0.89	2.89	73	43
Geneva	0.91	1.87	73	47
Hanover	1.17	3.57	77	47
Lodi	0.96	1.91	74	50
Niagara Falls*	0.81	2.49	75	46
Penn Yan*	0.93	1.77	75	48
Rochester*	1.07	1.95	77	48
Sodus	0.75	2.36	76	41
South Bristol	0.97	2.03	73	45
Varick	1.65	3.16	75	48
Versailles	1.18	2.93	76	42
Williamson	0.52	1.51	76	44

Accumulated Growing Degree Days (AGDD)
Base 50°F: April 1 - June 17, 2019

Location	2019	2018	2017
Albion	446	707	594
Arkport	429	767	565
Bergen	444	658	571
Brocton	478	NA	NA
Buffalo*	433	752	624
Burt	367	593	543
Ceres	497	628	563
Elba	416	684	571
Fairville	407	630	565
Farmington	428	661	568
Fulton*	403	637	569
Geneva	460	680	603
Hanover	477	701	NA
Lodi	492	713	661
Niagara Falls*	399	788	694
Penn Yan*	498	724	653
Rochester*	516	764	654
Sodus	399	619	587
South Bristol	442	674	589
Varick	513	720	658
Versailles	484	687	665
Williamson	376	601	604

* Airport stations
** Data from other station/airport sites is at: http://newa.cornell.edu/ Weather Data, Daily Summary and Degree Days.

Cornell Cooperative Extension
Cornell Vegetable Program

480 North Main Street
Canandaigua, NY 14424

VEGEdge

YOUR TRUSTED SOURCE FOR RESEARCH-BASED KNOWLEDGE

VEGEdge

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VegEdge is the award-winning newsletter produced by the Cornell Vegetable Program. It provides readers with information on upcoming meetings, pesticide updates, pest management strategies, cultural practices, marketing ideas and research results from Cornell and Cornell Cooperative Extension. VegEdge is produced every few weeks, with frequency increasing leading up to and during the growing season.

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Cornell Cooperative Extension
Cornell Vegetable Program

For more information about our program, email cce-cvp@cornell.edu or visit us at CVP.CCE.CORNELL.EDU