Late blight has been confirmed in Erie County! All of WNY is at risk! All tomato and potato growers should be applying a protectant fungicide.

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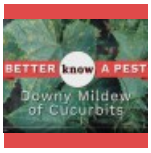

Downy mildew is confirmed in WNY. Here's a short video that shows the different stages of the disease and possible outcomes if not controlled.

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As snap beans come into flower, it's time to control pod molds. Fungicide options for control of gray mold and white mold are provided.

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In 2016, fields of cabbage had to be disked up because of uncontrollable populations of diamondback moth due to insecticide resistance.

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VEGEdge

YOUR TRUSTED SOURCE FOR RESEARCH-BASED KNOWLEDGE

Volume 13 | Issue 14 | July 12, 2017

Foliage pruned and plants getting sun from east. Early morning sun reduces the dew period. *Photo: Judson Reid*

Cornell University
Cooperative Extension
Cornell Vegetable Program

Late Blight Confirmed in Western New York!

Darcy Telenko and John Gibbons, CCE Cornell Vegetable Program

Late blight (LB) was confirmed in Erie County, NY on potato this week (the genotype is still being determined). **All of Western NY is at risk for Late Blight infection.** Severity values continue to build at all locations. Frequent and continuing rainfall has been extremely favorable for the development of LB. Scouts field twice a week. See the table for the Blight Units (BU) accumulation from around the region. The trigger in the Decision Support System (DSS) forecast for applying a fungicide is 30 BUs if the variety is susceptible. All tomato and potato growers, conventional and organic, should be applying a protectant fungicides and monitoring the DSS to determine spray intervals. Albion and Wellsville are two sites that have exceeded the 30 BUs, this past which triggers the recommendation for an addition fungicide application.

Potato leaf with white sporulation on margin of late blight lesion. *Photo: C. MacNeil, CVP*

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VegEdge newsletter is exclusively for enrollees in the Cornell Vegetable Program, a Cornell Cooperative Extension regional agriculture team, serving 13 counties in Western New York.

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.

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The next issue of VegEdge will be July 19, 2017.

Downy mildew has been confirmed in western NY. It is a potentially devastating disease to cucurbits. It usually affects cucumbers and cantaloupes first; later in the season it can be found on summer squash and zucchini. During some seasons, downy mildew can spread to winter squash and watermelons. Growers need to be monitoring their fields. This short video, created by the Cornell Vegetable Program, shows the different stages of the disease and possible outcomes if it is not controlled.

Watch the video on the CVP's YouTube channel at https://youtu.be/E4cs2UP9DQs.

continued from cover – Late Blight Confirmed in Western New York

Fungicides with systemic or systemic/translaminar activity include mefenoxam containing products (Ridomil Gold Bravo, Ridomil Gold Copper and Ridomil Gold MZ WG) as long as we have LB types US22, US 23, and US24; Previcur Flex and Presidio SC. Other translaminar products include Revus, Revus Top, Forum, Curzate and Tanos. Several strobilurin products are also labelled for late blight, but need to be tank-mixed. Contact fungicides will also help protect the plant and include Ranman, Gavel, Zoxium, chlorothalonil and mancozeb (see potato table for more details).

If late blight is suspected, act immediately! Under favorable environmental conditions late blight develops very rapidly and can spread many miles in a short period.

Please **take a sample for isolate identification**. It is very important to **track disease movement**. Contact CCE Cornell Vegetable Program Specialists for assistance**:** Darcy Telenko at dep10@cornell.edu or 716-697-4965 or nearest CVP Specialist to you at https://cvp.cce.cornell.edu/contact_information.php

***New* Late Blight Risk Chart, 7/11/17**

Location[1]	Blight Units[1] 7/05-7/11	Blight Units[2] 7/12-7/14	Location[1]	Blight Units[1] 7/05-7/11	Blight Units[2] 7/12-7/14
Albion	37	21	Lodi	0	14
Baldwinsville	13	20	Lyndonville	12	21
Bergen	12	20	Medina	14	20
Buffalo	19	20	Niagara Falls	18	20
Ceres	24	21	Penn Yan	18	21
Elba	5	14	Rochester	29	20
Fairville	18	20	Sodus	20	21
Farmington	19	20	Versailles	25	21
Gainesville	NA	NA	Volney	6	19
Geneva	10	20	Wellsville	32	21
Kendall	12	20	Williamson	12	20
Knowlesville	1	14	Wolcott	14	20

[1] Past week Simcast Blight Units (BU)
[2] Three day predicted Simcast Blight Units (BUs)

Late Blight and Downy Mildew in Tunnels/Greenhouse

Judson Reid, CCE Cornell Vegetable Program

This week we received the unfortunate news of confirmed cases of both Late Blight (potatoes) and Downy Mildew (cucumbers) in western New York. High tunnels have been promoted as a tool for preventing these diseases. Does this mean they can't occur inside?

Late blight sporulation on greenhouse tomato, August 2014.
Photo: J. Reid, CCE CVP

No, both diseases can infect plants grown inside tunnels and greenhouses. The two pathogens that cause the diseases (*Phytothphora infestans* and *Pseudoperonospora cubensis*) infect when there is leaf moisture (although it appears that Downy Mildew may require less free standing moisture than Late Blight). This means that we can manage these diseases by excluding rain from the crop. However, tunnels can create conditions that lead to free water on the foliage:

- Shade to the east such as buildings, trees or hedgerows that prolong a morning dew period.
- Excess soil moisture leads to guttation (water droplets on foliage).
- High density plantings or unpruned foliage traps moisture in the canopy.
- Lack of ventilation (inadequate or closed too long) leads to condensation on the plastic which rains on the plants.

Unpruned, high density plantings will have more moisture in the canopy. This increases the late blight risk.
Photo: J. Reid, CCE CVP

Management in the tunnel means keeping foliage dry through regular leaf pruning, roll-up sides open as much as possible, watering in the morning and proper site selection. Since the two pathogens are in the same class of organism, the same fungicides are effective on both. Before applying a fungicide inside a tunnel we must check the label to be sure there are no greenhouse prohibitions listed. Note that PHIs for the same product can differ from tomato to cucumber. Chlorothalonil is prohibited from greenhouse vegetable use, so another protectant such as copper will need to be added to the program. Revus and Previcur Flex are conventional options, whereas organic growers can use OMRI approved copper materials. The good news is that fungicide applications inside (both organic and conventional) are long lasting, and do not need the frequency of outside application. Growers with high tunnels may find they need no fungicides at all.

Proactive Management of Molds in Snap Beans

Julie Kikkert, CCE Cornell Vegetable Program

As snap beans come into flower, it's time to control pod molds. Gray mold (GM) develops in dense plant canopies when the weather is warm and moist. White mold (WM) requires both moist soil conditions and leaf wetness (a light dew is enough). Dry soils and high temperatures will inhibit the development of this disease. White mold is most abundant when temperatures range from 55-60°F, but will develop at temperatures as high as 85°F. Scout fields with a history of white mold. Sclerotia in the top 1" of the soil surface will germinate and produce mushroom cups and spores that will subsequently infect the plants. Dense plant canopies also increase the risk of molds.

White mold.
Photo: H. Dillard, Cornell

If the weather is conducive to disease, two fungicide applications are generally recommended: the first at about 10-40% bloom (since % bloom increases about 20% per day) and the second a few days later (100% bloom) according to weather conditions and label limitations. Your first spray will include open blossoms, buds, and blossom initials. In a 2016 trial with 'Huntington' snap beans at the Geneva Experiment Station (Pethybridge, et al., 2017 Empire Expo Proceedings http://tinyurl.com/2017Expo-whitemold) the timing of the fungicides, Topsin 4.5 FL and Omega 500 F was found to significantly affect the incidence of white mold. The optimal timing of Topsin 4.5 FL was 10% flowering. Delaying the application of Topsin 4.5 FL to 100% flowering resulted in the incidence of white mold being not significantly different from in nontreated plots. The application timing of Omega 500 F was found to be more plastic with no significant difference in disease control between 10% and 100% flowering.

There are several fungicide options for control of WM and GM in snap beans (see table). Commonly used tank mixes include Topsin M + Rovral; Topsin M + Endura; Topsin M + Bravo or Bravo + Rovral. Omega is a newer product, with very good efficacy. Priaxor provides suppression only. Regardless of the fungicides selected, good spray coverage is needed. Best results have been obtained using high gallonage (50 gal/A minimum) and high pressure (100 to 200 psi). Fungicide sprays must be directed towards the blossoms for good control.

Foliar fungicides labeled for white and gray mold in snap beans in New York

Product Name	Active Ingredient	Resistance Group	White Mold	Gray Mold
Bravo Weatherstik	chlorothalonil	M5	No	Yes
Endura 70 WDG	boscalid	7	Yes	Yes
Omega 500F	fluazinam	29	Yes	Yes
Priaxor	fluxapyroxad+propiconazole	7 + 11	Yes	Yes
Rovral 4F	iprodione	2	Yes	Yes
Switch 62.5 WG	cyprodinil + fludioxonil	9 + 12	Yes	No
Topsin	thiophanate-methyl	1	Yes	Resistance Issues

If you think your white mold control isn't working, you could be dealing with Phytophthora blight instead. Look for dying leaves and foliage especially in wet spots or where heavy downpours occurred. When Phytopthora blight infects the pods, they become whitish and shriveled. WM, GM and Phytophthora blight often occur in the same field. Please contact one of our team members if you need assistance with identification.

Early Blight of Tomato, Potato, and Eggplant

Darcy Telenko, CCE Cornell Vegetable Program

Active early blight lesions have been found in western NY on tomato, eggplant and potatoes. This disease can be present in fields and greenhouses that have received a steady supply rain or foliar irrigation. Early blight decreases leaf surface area, which in turn causes a reduction in tuber and fruit number, size, and quality. Although plant loss due to early blight rarely exceeds 20%, losses of 70-80% have been reported.

Symptoms of early blight are first observed as small brownish-black lesions on the lower leaves near to or touching the ground. This symptom is shortly followed by yellowing of leaves around the abrasions. Lesions enlarge rapidly in a matter of days to form concentric rings ("bullseyes" or "targets") Sunken brown lesions can also form on the stems of tomato and potato plants, and can cause collar rot in transplants and smaller plants (see photos). Tomato fruit can become infected with sizable round concentric rings near the stem attachment in either the green or ripe stage. Tubers show infection through sunken irregularly shaped lesions. Symptoms and losses are magnified when early blight is present in conjunction with another disease such as Verticillium wilt or blackleg.

Initial dark lesion surrounded by yellow halo of early blight on tomato leaf.

Concentric rings in early blight lesions on eggplant.
Photos: D. Telenko, CCE CVP

Foliar symptoms can be reduced, but not eliminated; by the application of protectant fungicides (see table). The optimum time for the first fungicide application is when airborne spores first appear. Higher rates of fungicide may be necessary as the season progresses. Early blight can overwinter in plant debris and soil, so it is good to rotate an infected field out of tomato/potato production for at least two years. The disease can survive from season to season on a variety of weeds, including horse nettle and black nightshade, so proper weed management during rotation is also important. To further avoid future infection, fully remove all tomato debris from the field after harvest. Postharvest, store slightly infected fruits and tubers in a cool dry area to slow the rate of development.

Fungicides labeled for use in TOMATO for early and late blight disease management, 2017.

Name	Diseases	FRAC Group	REI	PHI	Rate/A
Curzate 60 DF	Late blight	27	12 h	3 d	3.2-5 oz
Forum	Late blight	40	12 h	4 d	6.0 fl oz
ProPhyt or OLP	Late blight	33	4 h	0 d	4 pt
Presidio	Late blight	43	12 h	2 d	3-4 fl oz
Ranman 400 SC	Late blight	21	12 h	0 d	2.1-2.75 fl oz
Ridomil Gold Bravo SC	Late blight	4	48 h	5 d	2.5 pt
Zampro	Late blight	45 + 40	12 h	4 d	14 fl oz
Zing!	Late blight	22 + M3	12 h	5 d	36 fl oz
Ariston	Late blight, Early blight	27 + M3	12 h	3 d	1.9-3.0 pt
Cabrio	Late blight, Early blight	11	12 h	0 d	8-16 oz
Catamaran	Late blight, Early blight	M5 + 33	12 h	0 d	5-7 pt
Flint	Late blight, Early blight	11	12 h	3 d	2-4 oz
Gavel 75 DF	Late blight, Early blight	22 + M3	48 h	5 d	1.5-2 lb
Previcur Flex	Late blight, Early blight	28	12 h	5 d	0.7-1.5 pt
Quadris F or OLP	Late blight, Early blight	11	4 h	0 d	6.2 fl oz
Quadris Opti	Late blight, Early blight	11 + M5	12 h	0 d	1.6 pt
Reason 500 SC	Late blight, Early blight	11	12 h	14 d	4.0- 8.2 fl oz
Revus Top	Late blight, Early blight	40 + 3	12 h	1 d	5.5-7 fl oz
Tanos 50 DF	Late blight, Early blight	11 +27	12 h	3 d	6-8 oz
Bravo Weather Stik or OLP	Late blight, Early blight	M5	12 h	0 d	1.375-2.75 pt
Champ or OLP	Late blight, Early blight	M1	48 h	0 d	1.3 pt
ManKocide	Late blight, Early blight	M3 + M1	48 h	5 d	1-3 lb
Dithane DF Rainshield	Late blight, Early blight	M3	24 h	5 d	1.5 lb
Endura 70 WDG	Early blight	7	12 h	0 d	2.5-3.5 oz
Inspire Super	Early blight	3 + 9	12 h	0 d	16-20 oz
Priaxor	Early blight	7 + 11	12 h	0 d	4-8 fl oz
Quadris Top	Early blight	11 + 3	12 h	0 d	8 fl oz
Rhyme 2.08 SC	Early blight	3	12 h	0 d	3.5-7 fl oz
Scala SC	Early blight	9	12 h	1 d	7 fl oz
Serenade Opti	Early blight	44	4 h	0 d	14-20 oz
Sonata	Early blight	44	4 h	0 d	2-4 qt
Switch 62.5 WG	Early blight	9 + 12	12 h	0 d	11-14 oz
Ziram	Early blight	M3	48 h	7 d	3-4 lb

Fungicides labeled for use in POTATO for early and late blight disease management, 2017.

Name	Diseases	FRAC Group	REI	PHI	Rate/A
Curzate 60 DF	Late blight	27	12 h	3 d	3.2-5 oz
Forum	Late blight	40	12 h	4 d	6.0 fl oz
Omega	Late blight	29	12 h	14 d	5.5 fl oz
ProPhyt or OLP	Late blight	33	4 h	0 d	4 pt
Ranman 400 SC	Late blight	21	12 h	0 d	2.1-2.75 fl oz
Ridomil Gold Bravo SC	Late blight	4	48 h	5 d	2.5 pt
Zampro	Late blight	45 + 40	12 h	4 d	14 fl oz
Zing!	Late blight	22 + M3	12 h	5 d	36 fl oz
Ariston	Late blight, Early blight	27 + M3	12 h	3 d	1.9-3.0 pt
Cabrio Plus	Late blight, Early blight	11 + M3	24 h	3 d	2.9 lb
Catamaran	Late blight, Early blight	M5 + 33	12 h	0 d	5-7 pt
Gavel 75 DF	Late blight, Early blight	22 + M3	48 h	5 d	1.5-2 lb
Gem	Late blight, Early blight	11	12 h	7 d	3.8 fl oz
Headline	Late blight, Early blight	11	12 h	3 d	6-12 fl oz
Previcur Flex	Late blight, Early blight	28	12 h	5 d	0.7-1.5 pt
Quadris Opti	Late blight, Early blight	11 + M5	12 h	0 d	1.6 pt
Reason 500 SC	Late blight, Early blight	11	12 h	14 d	4.0- 8.2 fl oz
Revus Top	Late blight, Early blight	40 + 3	12 h	1 d	5.5-7 fl oz
Super Tin 80 WP or OLP	Late blight, Early blight	30	48 h	7 d	1.87 oz
Tanos 50 DF	Late blight, Early blight	11 + 27	12 h	3 d	6-8 oz
Bravo Weather Stik or OLP	Late blight, Early blight	M5	12 h	0 d	1.375-2.75 pt
Champ or OLP	Late blight, Early blight	M1	48 h	0 d	1.3 pt
Elixir	Late blight, Early blight	M5 + M3	24 h	7 d	1.2-2 lb
ManKocide	Late blight, Early blight	M3 + M1	48 h	5 d	1-3 lb
Polyram	Late blight, Early blight	M3	24 h	3 d	2 lb
Dithane DF Rainshield	Late blight, Early blight	M3	24 h	5 d	1.5 lb
Endura 70 WDG	Early blight	7	12 h	0 d	2.5-3.5 oz
Quash	Early blight	3	12 h	1 d	2.5-4.0 oz
Polyram 80 DF	Early blight	M3	24 h	3 d	2.5-4.0 oz
Priaxor	Early blight	7 + 11	12 h	0 d	4-8 fl oz
Quadris Top	Early blight	11 + 3	12 h	0 d	8 fl oz
Rovral 4F or OLP	Early blight	2	24 h	12 d	1-2 pt
Scala SC	Early blight	9	12 h	1 d	7 fl oz

CROP INSIGHTS

Tighten up plant protection programs as recent moisture has been perfect for many of our major disease issues across various crops. In the last week, we have seen almost every major disease we watch for in vegetables including not only our fungal and bacterial leaf diseases but a number of soilborne diseases including white mold and Phytophthora blight.

CUCURBITS

Downy mildew was detected and confirmed on cucumber in Erie County, NY late last week. Preventative programs should be tightened in the region to make sure all new foliage is protected.

Stripped and spotted cucumber beetles are still quite active. Their early season feeding on various cucurbits has not only reduced some stands in areas but we are starting to see bacteria wilt. The bacterium, *Erwinia trachoephila,* is spread by both types of cucumber beetle. This disease is most common on cucumber and melon but can also be seen in susceptible varieties of gourd, pumpkin and squash. This week I have seen it appearing in early zucchini plantings, cucumbers, and winter squash. The bad news is at this point there is nothing to do, the good news is that it will not spread from plant to plant. Symptoms will appear on a single leaf which suddenly wilts - the bacteria spread through the xylem vessels of the infected tissue causing them to turn brown and die.

Bacteria wilt in zucchini. *Photo: D. Telenko, CVP*

EGGPLANT

Watch for insect feeding on eggplant – we continue to see issues with flea beetle and Colorado potato beetle. We've even found early blight lesions on eggplant – environmental conditions are just right.

ONION

Stemphylium leaf blight (SLB) lesions are developing as onions are bulbing and especially in fields that have suffered weather injury (Fig. 1). All fields should include fungicide(s) to control SLB; fungicides that belong to FRAC groups 3 and 7 generally provide best control of SLB, and ideally you should include one of these each week. See Onion fungicide cheat sheet onion (available online at CVP website https://rvpadmin.cce.cornell.edu/uploads/doc_583.pdf), and article on SLB fungicide programs in last week's VegEdge for more information. Inner leaf dieback from bacterial diseases also increased in frequency this past week. Surchlor is a sodium hypochlorite product that is now labeled on onion for bacterial diseases. In preliminary side-by-side comparisons in grower field-scale demonstrations last year, it numerically reduced bacterial bulb decay in 10 out of the 14 comparisons, while bacterial disease was higher with sodium hypochlorite in one case and there were no differences in the other two. It is recommended that Surchlor be added to the tank mix every week for improved control of bacterial diseases. More side-by-side comparison trials are underway again this year to collect more data on the efficacy of this product. For more information on Surchlor, see June 7th issue of VegEdge.

Figure 1. Severe weather (driving heavy rain and hail) damage to onion leaves, 2 days after weather event (A). Tan lesions of Stemphylium leaf blight on necrotic tissue of outer leaves (B & C) and wound sites (D). *Photos: C. Hoepting, CVP*

Onion thrips (OT) remain very low in both fields that have been and have not been treated with Movento. However, OT counts spiked to over 3 OT per leaf at "influx sites" in Elba this week. Influx sites are where OT migrate in mass into onions from another source such as cutting of hay or harvest/dry down of wheat. There are noticeably a lot more beneficial insects in onion fields these days now that selective insecticides such as Movento and Radiant are being relied on for onion thrips control, instead of broad-spectrum ones like the pyrethroids (e.g. Warrior) (Fig. 2).

continued on next page

Figure 2. Beneficial insects that occur in onion where selective insecticides such as Movento are used to control onion thrips including egg (A), larvae (B & C) and adult (D) stages of seven spot lady bird beetle, and Syrphid fly larvae (E). Syrphid fly larvae feed on onion thrips. When broad-spectrum pyrethroid, OP and carbamate insecticides were relied on for onion thrips control, sightings of such beneficial insects in onions were rare. *Photos: C. Hoepting, CVP*

POTATO

See **late blight** update (cover article); it **is here in western NY**. Also keep an eye out for early blight as we are starting to find it in small pockets around the region (see early blight article, page 4). Colorado potato beetles are still quite active in pockets. We are also seeing tip burn from potato leaf hopper.

SWEET CORN

Wildlife have started to get into sweet corn just as we have ears ready to pick – raccoons are quite active. We have initiated our deterrent bird trials this week with a 3-week prior to harvest treatment; 2-week prior to harvest treatments will go out at the end of week and early next. We are looking at using various scare tactics (air-dancer, scare-eye balloons), detasseling and chemical (Avian Control) and will keep you posted on their effectiveness.

Raccoon damage in sweet corn (left and above). *Photos: D. Telenko, CVP*

TOMATO

We have seen several tomato diseases appearing in the region. This includes early blight, Septoria leaf blight and bacteria speck. Late blight has been confirmed in Erie County, so make sure protectants are going out on all tomatoes. Management is hard mainly due to the disease being dispersed by splashing water. Heavy rains will splash up infected soil onto the leaves and stems and many of these diseases can take hold. Preventive sprays are necessary to keep these diseases at a manageable level. Some of the same products can be used for each disease. Be sure to read label directions to be sure each are listed.

Tomato leaf diseases are prevalent this season. Early blight (above) and Septoria leaf blight (right) are common sites. *Photos: T. Zitter, Cornell*

Another problem seen repeatedly this season has been distorted leaves and stem growth on some field grown tomatoes. If you have grown tomato transplants in the same greenhouse as ornamentals or purchased plants from a mixed horticultural operation, there is a good chance your transplants could be infested with broadmites. These microscopic pests are nearly impossible to be seen with the naked eye. Despite their small size, they can wreak havoc on tomato and pepper transplants. Management of this pest needs to begin in the greenhouse. Don't grow vegetable transplants in the same facility as ornamentals such as petunias, impatiens, and other plugs purchased from propagation nurseries. Use approved insecticides labeled for greenhouse use. For field use, select miticides that specifically list broadmite on the label.

Distorted tomato leaflets due to broadmite feeding. *Photo: R. Hadad, CVP*

Managing Diamondback Moth in Cabbage in the Face of Insecticide Resistance

Christy Hoepting, CCE Cornell Vegetable Program, and Brian Nault, Dept of Entomology, NYSAES, Cornell

Fields disked up due to uncontrollable Diamondback moth – Last year, fields of cabbage had to be disked up due to uncontrollable populations of diamondback moth (DBM) (Fig. 1). A late season small-plot research trial in one of these fields revealed that insecticides belonging to three different IRAC (Insecticide resistance action committee) groups or modes of action (MOA) FAILED to control this DBM population.

Figure 1. Feeding damage, frass and larvae/pupa contamination of diamondback moth (DBM) from severe DBM infestation. In 2016, cabbage fields had to be disked up because of uncontrollable DBM populations. *Photo: C. Hoepting, CVP*

Coragen, Warrior, Voliam Xpress and Avaunt FAILED to control DBM – In the 2016 study, treatments consisted of two consecutive applications of insecticides applied 7 days apart on Sep-15 and Sep-21. Treatments included the highest labeled rates of Coragen, Warrior II Zeon Technology, Volium Xpress (a premix of Coragen + Warrior; now marketed as Beseige), Avaunt, Radiant, Proclaim, Lannate SP, and Lannate SP + Agree. All treatments were co-applied with surfactant LI700 @ 0.25% v/v. In the latter treatment, Agree was only included in the second application. Treatments were replicated five times. One week after the first application, total DBM larvae and pupa averaged 24 per plant in the untreated control, which increased by 33% one week later to 33 per plant. Numbers of DBM small larvae, large larvae and pupa were tallied separately in both the head and the wrapper leaves of 6 cabbage plants per plot. No matter how the data were analyzed, whether it was by the individual DBM stage categories in the different parts of the cabbage plants, or all combined, Coragen, Warrior, Volium Xpress and Avaunt consistently FAILED to control DBM (Fig. 2). These insecticides belong to three different MOA including 3A, 22A and 28 (Table 1).

In this case, the DBM population likely originated from Georgia and came into New York on bare root transplants. In 2016, there were reports from Georgia and Florida of failure of every single insecticide labeled in Cole crops to control DBM. By the same token, these states also had good control with most every product. In general, Proclaim, Exirel and Bts resulted in best DBM control. In Georgia, 21,000 acres of Cole crops are grown year round and under these production conditions, DBM, whose lifecycle is 28 to 67 days, has

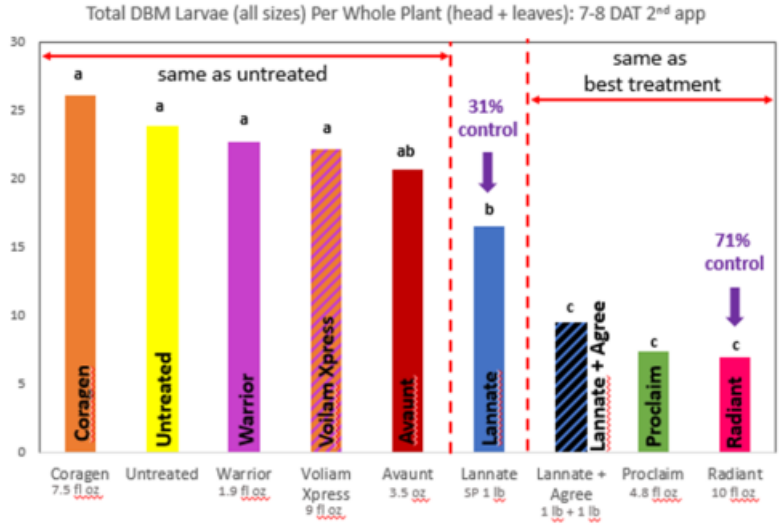

Figure 2. Relative efficacy of selected insecticides for controlling very high diamondback moth (DBM) infestations (e.g. 24 and 32 DBM per plant in the untreated control 7 and 14 days after the first and second insecticide applications, respectively). Treatments were applied on Sep-15 and 21 with LI700 @ 0.25% v/v. Note, in the Lannate + Agree treatment that Agree was only included in the second application. Bars with the same letter are not significantly different from each other, Fisher's Protected LSD test, p<0.05 (Hoepting 2016).

Table 1. Different modes of action (MOA) of insecticides for control of diamondback moth (DBM) in New York, 2017.

Mode of Action (IRAC Group)		Active ingredient	Trade Names
Numerical Code	MOA		
11A	*Bacillus thuringiensis*	B.t. var. *aizawai*	Agree WG; Xen Tari
		B.t. var. *kurstaki*	DiPel DF, Biobit HP, others
1A	Carbamates	methomyl	Lannate LV, SP
3A	Pyrethroids	lambda-cyhalothrin Several others	Warrior II Zeon Technology Perm-Up, Ambush, Asana, Capture, etc.
28	Diamides	chlorantraniliprole	Coragen
		cyantraniliprole	Exirel, Verimark
6	GluCl modulators	emamectin benzoate	Proclaim WDG
22A	Oxadiazines	indoxacarb	Avaunt
5	Spinosyns	spinetoram	Radiant SC
28 + 3A	Diamide + Pyrethroid	chlorantraniliprole + lambda-cyhalothrin	Voliam Xpress/Beseige

about 15 generations per year. Not surprisingly, insecticide resistance may be quick to develop. Unfortunately, in just seven years since its introduction to the market, DBM has become resistant to Coragen.

Proclaim and Radiant provided 70% control of DBM under extremely high pressure – Fortunately, DBM is not known to overwinter in New York, so any insecticide-resistant populations that are brought in on bare root transplants or migrate from the south will not survive overwinter. However, as the weather gets crazier with record-breaking mild winters, it may only be a matter of time… In the meantime, note that Proclaim and Radiant provided 70% control of this "uncontrollable" DBM population (Fig. 2). Lannate alone provided mediocre control (~31%) and was able to hold the population instead of allowing it to increase between the first and second insecticide application. When Agree (Bt)

continued on next page

was added to the second application of Lannate, DBM population decreased and was significantly lower than Lannate alone (Fig. 2). Perhaps, Bt was responsible for a majority of the control in the Lannate and Bt tank mix.

Avoid DBM Insecticide Resistance in NY – Even if you do not plant bare root cabbage transplants from a southern state with a history of DBM resistance, respecting insecticide resistance management guidelines will ensure the longevity of highly effective insecticides for decades to come.

Rules for Insecticide Resistance Management for DBM:

- Rotate IRAC groups/MOAs to not expose consecutive DBM generations to the same group.
- Do not use the same MOA more than twice in a growing season.
- Do not apply the same insecticide more than twice in a growing season.

Table 2 illustrates a DBM insecticide-resistance management plan in both a typical and a difficult season, where sprays are warranted every 2-3 weeks and every 1-2 weeks, respectively, to keep DBM below economically damaging levels. A single generation of DBM from egg to larvae to pupa to adult ranges from 28 to 67 days, so we estimated shorter generation times during the heat of July and August than those in September and October.

In a typical season, we would recommend exposing only one MOA per DBM generation, with no more than two sprays per MOA, which could fall on weeks 1 and 3 for the first generation, weeks 5 and 7 for the second generation, and weeks 10 and 13 for the third generation. In this example, we chose to use a Bt (IRAC 11A) for the first generation, because it is not harmful to beneficial organisms that may give a helping hand in control of DBM and imported cabbage worm (ICW). Radiant (IRAC 5) was chosen for the second DBM generation in August, because it is also softer on beneficial insects than some products, and will also control large cabbage loopers (CL) and onion thrips, which are more problematic towards the end of summer than earlier in the season. Proclaim (IRAC 6) was chosen for the third generation, because it was found to be the most effective insecticide, when DBM pressure is expected to be the highest. Lannate (IRAC 1A) and pyrethroids (IRAC 3A) such as Warrior, have broad-spectrum activity and can be harmful to beneficial insects. Note, the other insect pests of Cole crops that the different insecticides also do or do not control.

In a difficult season, each DBM generation is exposed to two different MOAs with no more than two sprays per MOA, and never any repeat use of the same MOA per season.

Whatever MOAs you chose and how you decide to rotate them, **do your best to not expose consecutive generations of DBM to the same MOA.** Pay attention to the insecticides that you use to control flea beetles and onion thrips and make sure that they do not interfere with your rotation strategy for resistance management of DBM. For example, if pyrethroids were used to control thrips in August during second generation of DBM, then you should not use them again for DBM control in September during the third DBM generation.

Don't start with IRAC 28 if Coragen is used at planting for cabbage maggot control – Several growers use Coragen (IRAC 28) at planting for control of cabbage maggot. Because this product has a 4-6 week residual, and also has activity against DBM, this means that the first generation of DBM will be exposed to Coragen. Therefore, Coragen or any other product belonging to IRAC 28 including Volium Xpress/Beseige and Exirel should not be used for the remainder of the season, or at least not until the third generation (skip exposure to the second generation).

Table 2. Diamonback Moth (DBM) Insecticide Resistance Management Plan that also considers management of other major Cole crop pests.

Typical season:

Month	At	July				August				September				October			
Week	Planting[3]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DBM[5]		Generation 1				Generation 2					Generation 3						
Insecticide MOA[1]		MOA 1				MOA 2					MOA 3						
Insecticide Spray		Spray 1		Spray 2		Spray 3		Spray 4			Spray 5			Spray 6			
IRAC[2]	1B/ 28	11A		11A		5		5			6			6			
E.g. Insecticide (Trade Name)	Lorsban/ Coragen	Agree, Xentari, Dipel		Agree, Xentari, Dipel		Radiant		Radiant			Proclaim			Proclaim			
Other insect pests controlled[4]	CM	ICM, sm CL		ICM, sm CL		ICM, CL, thrips		ICM, CL, thrips			ICM, CL			ICM, CL			

Difficult Season:

DBM[5]		Generation 1				Generation 2				Generation 3		
Insecticide MOA[1]		MOA 1		MOA 2		MOA 3		MOA 4		MOA 5		MOA 6
Insecticide Spray		Spray 1	Spray 2	Spray 3	Spray 4	Spray 5	Spray 6	Spray 7	Spray 8	Spray 9	Spray 10	Spray 11
IRAC[2]	1B/ 28	11A	11A	5	5	6	6	28	28	22A	22A	3A
E.g. Insecticide (Trade Name)	Lorsban/ Coragen	Agree, Xentari Dipel	Agree, Xentari Dipel	Radiant	Radiant	Proclaim	Proclaim	Coragen Beseige (+3A), Exirel	Coragen, Beseige (+3A), Exirel	Avaunt	Avaunt	Warrior
Other insect pests controlled[4]	CM	ICM, sm CL	ICM, sm CL	ICM, CL, thrips	ICM, CL, thrips	ICM, CL	ICM, CL	ICM, CL, thrips, CM, FB	ICM, CL, thrips, CM, FB*	ICM, CL	ICM, CL	ICM, sm CL, thrips, FB

[1]**MOA**: Mode of Action. [2]**IRAC**; Insecticide Resistance Action Committee chemical class. [3]Insecticide applied at planting for cabbage maggot control. Since Coragen is systemic and also has activity against DBM, this application may also provide control of DBM. Lorsban has no activity on DBM. [4]**Other insects controlled: ICM:** imported cabbage worm; **(sm) CL:** (small) cabbage looper; **thrips:** onion thrips; **CM:** cabbage maggot; **FB:** flea beetle. [5]DBM lifecycle from adult to eggs to larvae to pupa to adult is 28 to 67 days (Phillips *et al.* 2014). *only Besige controls FB.

UPCOMING EVENTS

view all Cornell Vegetable Program upcoming events at cvp.cce.cornell.edu

2017 Vegetable Pest and Cultural Management Field Meetings for Auction Growers

July 21, 2017 | 6:00 PM
Yates County rescheduled (from 6/30 to 7/21) – Allen Zimmerman farm, 3351 Hoyt Rd, Penn Yan, NY 14527

August 8, 2017 | 6:00 PM
Chautauqua County – Jacob Hostetler farm, 561 Frew Run, Frewsburg, NY 14738

These courses 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 Cornell Vegetable Program along with CCE associates Telenko and Hadad will instruct participants and facilitate peer-based learning. Details on each topic will focus on field observations at the farm.

This event is FREE! DEC recertification credits will be available. For more information about these events, contact Judson Reid at 585-313-8912 or jer11@cornell.edu.

WNY Soil Health Alliance Summer Field Day

August 22, 2017 | 8:30 AM - 3:30 PM
Orleans County 4-H Fairgrounds Trolley Bldg, 12690 Rt 31, Albion NY 14411

Two guest speakers will kick off this exciting event: Wendy Taheri, a nationally recognized expert in Mycorrhizal Fungi, and John Wallace, soon to be an Assistant Professor at Cornell with extensive experience in drilled interseedings of corn. In the afternoon, attendees will observe 8 cover crop trials and explore a soil pit, with on-site discussion led by Wendy Taheri, TerraNimbus LLC. There will also be cover crop interseeder and herbicide demonstrations. The full agenda and information on how to register is available at http://www.wnysoilhealth.com/events/. $40/pre-registered participant; $50/walk-in. Lunch included.

WNY Sweet Corn Trap Network Report, 7/11/17

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

Twenty-nine sites reporting this week. European corn borer (ECB)-E was trapped at seven sites and ECB-Z was trapped at six sites. Corn earworm (CEW) was trapped at nine sites, with four sites high enough to be on a 5 or 6 day spray schedule (see chart below). Fall armyworm (FAW) was trapped at three sites and Western Bean cutworm (WBC) was trapped at thirteen sites this week.

I scouted three fields this week that had ECB damage, over threshold, in the tassel. At two of the fields that tassels were broken over and the larvae had already entered the stalk. At the third site the tassels were just beginning to emerge from the whorl and the larvae were still actively feeding in the tassel. It is important to time spray applications to target the larvae when they leave the tassel but before they bore into the plant. Larvae feeding in the whorl are protected from insecticide applications and mortality will not be as high as at tassel emergence, when larvae feeding in the emerging tassel are exposed to the spray. Larvae will leave the tassel as it opens up and no longer provides a moist, protected feeding environment, and move down the plant looking for protected places to feed. Insecticide applications need to be timed to kill larvae before they bore into a new feeding location where again they will be protected from sprays. In fields with very uneven development, two applications may be necessary, one when approximately 25-50% of the tassels have emerged, and again after 75-100% of the tassels have emerged, if the field is still over threshold.

Degree-day accumulations in relation to percent moth emergence (beginning May 1, base 50°F)

Accumulated Degree-days	% Moth Emergence
1319	25%
1422	50%
1536	75%

Percent WBC moth emergence based on degree day accumulation, data from University of Nebraska

WNY Pheromone Trap Catches: July 11, 2017

Location	ECB-E	ECB-Z	CEW	FAW	WBC	DD to Date
Baldwinsville (Onondaga)	1	1	1	0	1	937
Batavia (Genesee)	NA	NA	NA	NA	NA	833
Bellona (Yates)	NA	NA	NA	NA	NA	1012
Eden (Erie)	2	0	4	0	11	930
Farmersville (Cattaraugus)	0	0	0	0	6	948
Farmington (Ontario)	0	0	0	0	0	862
Hamlin (Monroe)	2	2	1	1	0	892
LeRoy (Genesee)	0	4	0	0	2	900
Pavilion	0	0	0	0	0	948
Penn Yan (Yates)	0	0	5	1	1	977
Ransomville (Niagara)	1	1	0	0	1	963
Seneca Castle (Ontario)	0	0	0	0	0	914
Williamson (Wayne)	0	0	1	0	3	849

ECB - European Corn Borer
CEW - Corn Earworm
FAW - Fall Armyworm
WBC - Western Bean Cutworm
NA - not available
DD - Degree Day (modified 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.

Weather Charts

John Gibbons, CCE Cornell Vegetable Program

Weekly Weather Summary: 7/4 – 7/10/17

Location	Rainfall (inch)		Temp (°F)	
	Week	Month July	Max	Min
Albion	0.39	0.49	86	52
Appleton, North	0.12	0.42	83	51
Baldwinsville	0.75	1.50	86	54
Buffalo*	0.26	0.28	85	57
Ceres	0.73	1.95	83	51
Elba	NA	NA	NA	NA
Fairville	1.01	1.51	83	50
Farmington	0.64	1.66	86	51
Gainesville	NA	NA	NA	NA
Geneva	0.43	1.35	82	54
Lodi	0.05	1.29	85	53
Niagara Falls*	1.29	1.69	86	58
Ovid	0.39	1.26	85	53
Penn Yan*	0.27	0.95	84	55
Phelps	0.45	1.49	86	56
Portland	0.06	0.36	79	58
Rochester*	0.52	0.90	86	55
Silver Creek	NA	NA	NA	NA
Sodus	NA	NA	82	55
Versailles	0.60	0.72	85	52
Volney	0.08	0.53	84	54
Williamson	0.21	0.62	84	53

Accumulated Growing Degree Days (AGDD) Base 50°F: April 1 – July 10, 2017

Location	2017	2016	2015
Albion	1032	1064	1072
Appleton, North	917	896	867
Baldwinsville	1066	1043	1093
Buffalo	1067	1086	1097
Ceres	928	813	976
Elba	NA	774	827
Fairville	985	926	NA
Farmington	982	968	1045
Gainesville	948	763	866
Geneva	1041	1011	1063
Lodi	1171	1115	1190
Niagara Falls	1171	1158	1005
Ovid	1109	1062	1140
Penn Yan	1117	1080	1142
Phelps	1025	990	1082
Portland	1108	1008	1031
Rochester	1115	1092	1162
Silver Creek	1069	964	990
Sodus	1031	982	987
Versailles	1076	947	1022
Volney	970	NA	NA
Williamson	1000	930	922

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

Cornell University
Cooperative Extension
Cornell Vegetable Program

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VEGEdge

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VegEdge is the award-winning newsletter produced by the Cornell Vegetable Program in Western New York. 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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