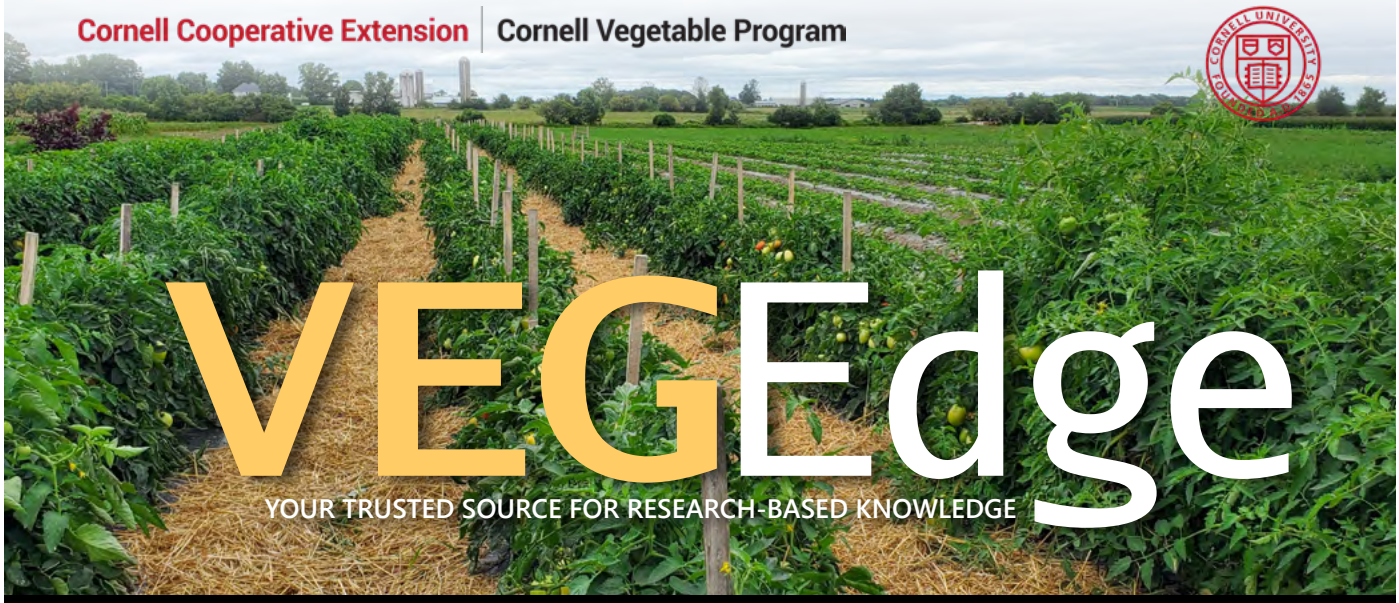
Cornell Cooperative Extension | Cornell Vegetable Program



VEGEdge

YOUR TRUSTED SOURCE FOR RESEARCH-BASED KNOWLEDGE

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The Hidden Blossom End Rot

Robert Hadad, Cornell Cooperative Extension, Cornell Vegetable Program

Probably the most common problem we see in tomatoes is blossom end rot. We all have seen it because it is so obvious. There are two situations needed to cause this physiological issue and it starts with plenty of moisture allowing for rapid plant growth which can easily come if there is plenty of rain early in the season. Secondly, a dry period when the plants have fruit in the early stage of development or if there is way too much rain and soil is very saturated resulting in little oxygen for the roots to function properly.

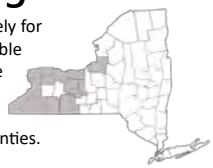
Calcium becomes unavailable in sufficient quantities when these conditions occur. The ability of the roots to take up enough water with dissolved calcium slows or is restricted. Fruit tissue becomes damaged and over time, rot begins. The rot is prevalent at the blossom end of the fruit.

What isn't obvious,sometimes, with blossom end rot, is that no external rot is seen but internal rot happens. It doesn't become apparent until the fruit is cut open when a consumer who purchases your tomatoes gets home and slices into it (Fig. 1). We have seen multiple cases of this already this season. Typically, paste tomato varieties are more susceptible to it but some slicers are as well.

The only way to be prepared for this is to be on top of irrigation and watching daily weather reports. Keep track of the rain events on the farm. Watch for periods of hot dry weather being forecasted. Add extra calcium to tomato plantings early in the season. Long-term, use cover crops to build up organic matter and improve aeration/water holding capacity.

Internal blossom end rot. *Photo: Shuresh Ghimire, UConn Extension*

About VegEdge



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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Contents

The next issue of VegEdge will be produced on August 21, 2024.

ALERT!
LATE BLIGHT Present in Western NY

Elizabeth Buck, CCE Cornell Vegetable Program

Late blight was reported on tomatoes in Cattaraugus County on Tuesday, 8/13. A second case on tomato was also reported from Spartansburg PA, 45 miles to the SW of the Cattaraugus County location. Both cases had clear symptom development including fruit lesions and rapidly declining plants. Symptoms were limited to small hot spots and are being treated.

The timing of symptom onset and patterning in the field suggests that late blight may have moved into the area with last week's storms. **With the widespread storms and long distance between the first two cases, it is possible that a large geographic region in WNY and northern PA could be experiencing cases.**

Scout your fields twice a week with heavy focus on areas with poor airflow. Late blight will attack both potato and tomato. **If you are south of the Thruway and west of Rt 19, treat all standing fields of both crops with a protectant and a late blight effective material** (see 2024 Veg Guidelines or call us).

Please give us a call if you suspect you have late blight. We rely on grower reports to help provide other regions with timely warning. Plus, we will help you develop a customized management plan!

CROP Insights

Observations from the Field and Research-Based Recommendations

COLE CROPS

Alternaria leaf spot (ALS) is present in a number of fields. See feature article for updated recommendations on page 6. The big news is that Cornell has confirmed that ALS has developed fungicide resistance to FRAC 7 boscalid (in Endura) on 5 farms in the CVP region. It is likely that there is cross-resistance among the other FRAC 7 active ingredients. Thus, Cornell is no longer recommending FRAC 7 for ALS and head rot. – CH

DRY BEANS

White mold is present in most fields and will likely continue to be a problem with all the wet weather that has moved across NYS. Aphids are being found in some dry bean fields as well as Mexican bean beetle (MBB). In high numbers MBB can defoliate plants quickly, as well as cause direct damage to bean pods, so it is important to monitor and treat fields if numbers get too high. Thresholds for MBB are >15% defoliation during pod-fill, and >25% defoliation during full-pod to harvest. – ML

Western Bean Cutworm Report

Western bean cutworm trapping continues at 16 locations in the region (Table 1). We saw a great decrease in numbers this week, and should see low to no flight in the next couple of weeks at most fields. Overall moth numbers appear to be higher this year compared to recent years.

Table 1. Western bean cutworm adult moth numbers by date for each dry bean trap location. Red text indicates peak flight.

Dry Bean Location	July 2	July 9	July 16	July 23	July 30	Aug 6	Aug 13	Cumulative Moths
Avoca Hill East (Steuben Co.)	0	0	38	284	209	41	8	**580**
Avoca Hill West (Steuben Co.)	1	5	23	29	8	4	3	**73**
Avoca Valley (Steuben Co.)	0	1	27	56	29	8	1	**122**
Caledonia (Livingston Co.)	3	23	29	66	160	38	21	**340**
Churchville (Monroe Co.)	5	45	70	57	125	52	9	**363**
East Bethany (Genesee Co.)	NA	7	82	96	102	28	8	**323**
LeRoy (Genesee Co.)	NA	7	101	244	210	85	24	**671**
North Chili (Monroe Co.)	1	0	11	16	34	28	5	**95**
Pavilion (Genesee Co.)	1	7	53	97	82	54	17	**311**
Penfield (Monroe Co.)	NA	7	33	99	131	72	17	**359**
Penn Yan North (Yates Co.)	NA	4	4	76	18	9	4	**115**
Penn Yan South (Yates Co.)	NA	3	3	118	61	12	4	**201**
Scottsville (Monroe Co.)	0	4	14	41	89	12	8	**168**
Wayland Hill (Steuben Co.)	0	13	45	124	167	99	10	**458**
Wayland Valley (Steuben Co.)	3	2	10	96	82	27	7	**227**
Wyoming (Wyoming Co.)	11	77	82	135	92	59	16	**472**

Now that peak flight and thresholds have been met, scouting should begin in dry beans. To scout for WBC, inspect 50 plants per field (10 stops, 5 plants per stop), looking at all pods present on the plant for holes. If damage into the pod and seed is found with no larva present, it is possible this is WBC. An insecticide application is recommended if dry bean pod damage is found. – ML

GARLIC

Neck Rot (Fig. 1) was diagnosed in the Finger Lakes on harvested garlic this week. This disease is caused by the pathogen *Botrytis porri*. This disease is like Sclerotinia White Mold, in that infection occurs via overwinter sclerotia (hard, black resting structures) that disperse spores under cool, moist conditions. The disease may be favored by wounds caused during scape removal. Excess fertility is also a causal factor. Crop rotation and clean seed pieces are the most effective management tools.

Figure 1. A Botrytis species causes neck rot, which decreases the marketability of the cloves. *Photo: J. Reid, CVP*

ONIONS

The news of the week is that it is **time for sprout inhibitor for storage bound onions** in many fields, as this year's crop is simply finishing up early. In fields that are dying back quickly, it is important to apply sprout inhibitor before they have < 5 green leaves, as < 3 leaves is really not enough – see article. Elba muck, Wayne Co. and Oswego Co. got ~ 0.8, ~ 1.5 and ~3 inches of rain last week. Nighttime dews and > 1.4 inch of rainfall/week tend to be favorable for leaf diseases, which for the most part was "holding" at fairly low or nonintimidating levels in Elba. Wayne and Oswego Cos. are being scouted today, but last week leaf diseases were quite low. Most growers have applied their 2 apps of FRAC 3 + 3, which is with the addition of Bravo 3 pt/A the best treatment we have. Usually, the last fungicide spray is applied at ~ 50% lodging and then sprout inhibitor is applied the following week (or sometimes sooner) with mancozeb for DM protection and sometimes copper bactericide to help with skin color and to dry down the necks. **If leaf dieback is 10% of less**

continued on page 4

continued from page 3

when lodging is 20% or more, that is usually a good indication that the crop will continue to lodge properly. A crop with only 10% dieback has plenty of green foliage that will translate into putting on bulb size. Such a crop should get our best (Viathon + Tilt + Bravo) or second-best (Miravis Prime + Rovral/Oso + FRAC P07 +/- Bravo) fungicide spray for a strong finish.

If plants have 40% or more dieback at 20% lodging, they are on track to die standing up, and may not be worth such an expensive fungicide spray and FRAC P07 + Bravo may just be "better than nothing". For fields that are track to die standing up, **gently rolling the foliage over so that the leaf axils are no longer exposed to splashing rain may prevent new bacterial infections form occurring**. We know: 1) there is greater risk for bacterial bulb rot when onion plants die standing up when they are exposed to a splashing rain event(s), and 2) rolling onions can reduce incidence of bacterial bulb rot. The unknown is whether there will be a weather event that would cause increased incidence of bacterial bulb rot. There is a lot of rain in the forecast, which may make it worthwhile to get some onions rolled this week.

Incidence of foliar symptoms of **bacterial bulb rot** jumped in some fields this week. Now, is the time to inspect the situation to try and get a read on potential incidence of bulb rot – more on this next week.

Onion thrips are increasing in some field again, in some cases from influxes coming into the field from somewhere else (onions or other). The Trifecta combo made of Agri-Mek SC 3.5 fl oz + Warrior 1.92 fl oz + Lannate LV 3 pt has been dynamite on thrips pressures as high as 9/leaf in Elba. Theoretically, Exirel 16 fl oz/A and Radiant 10 fl oz should also be able to take down 4-5 thrips/leaf. – CH

Ideal Conditions for Applying Sprout Inhibitor to Storage Bound Onions

Maleic hydrazide (MH) is a growth regulator applied to storage bound onions to prevent sprouting. Ideal conditions include:

- 50% tops down, plants have 5-8 green leaves to ensure adequate translocation into the bulb.
  - If MH is applied too late or when onions have been ravaged by disease or thrips when the plant has **less than 3 green leaves**, it will not be properly absorbed and the onions will start sprouting in storage.
  - If MH is applied to onion that is still **producing new leaves**, cell division will be stopped but individual cells will continue to grow in size. This will produce spongy bulbs where the scales pull away from each other that may not store well.
- Humid weather and temperatures less than 75°F are ideal.
  - **Low humidity (< 50%) and high temperatures (i.e. >80-85°F)** may cause MH to crystallize on the leaves, thereby inhibiting uptake.
- **No rain within 24 hours after application**, as this reduces uptake.
- Do not tank mix with sodium hypochlorite, a sanitizer treatment for bacterial diseases, as this tank mix can cause a severe chemical reaction.

PEPPERS

Root rot of peppers has been detected in the southern portion of the CVP territory this week. Key characteristics include a top-down wilt (Fig. 2), and roots will be poorly developed and black or brown (Fig. 3). Often the outer layer of the root (the epidermis), will be very dark and easily slides away from the internal layer (the cortex). Larger plants that experience a wilt from this disease complex are unlikely to revive, leading to complete crop loss for some growers. There are multiple pathogens that can cause this disease including Pythium, Rhizoctonia and Phytophthora species.

Figure 2. A top-down wilt and poor root system is common in Root Rot outbreaks. In this situation excess fertilizer and a tropical storm pushed the crop to the point of complete wilt. Dark green foliage is consistent with high soil nitrogen levels. *Photo: J. Reid, CVP*

Figure 3. Root of Pythium infected plants will be poorly developed and black or brown. Often the outer layer of the root (the epidermis), will be very dark and easily slides away from the internal layer (the cortex). High levels of fertilizer and cool saturated soils are high risk. *Photo: J. Reid, CVP*

continued on page 5

continued from page 4

Generally Root Rot, or the closely associated disease of Damping-Off, are early season seedling problems. Often associated with cold, saturated soils we see this most often in greenhouses, or in the field immediately after transplant. There are several factors that may have led to outbreaks this August. Spring planting season began early in the CVP region due to moderate temperatures and soil conditions. Growers were able to transplant early. Although there wasn't a late frost, soil conditions following transplanting were not particularly warm which led to slow, poor root development. Crops may have also picked up background infections of pathogens such as Pythium. High levels of fertilizers and other soil amendments are also complicit in root injury, which increases the risk of infection. These conditions were not severe enough to kill seedlings outright, however, as the crop set a fruit load, water demand increased. Then the remnants of Tropical Storm Debby hit the region on August 9, drenching soils with over 7 inches of rain in the Southern Tier and southern Finger Lakes region. This severe weather event suffocated root zones of already compromised plantings, leading to total wilt.

What can be done now? For those mature crops that have wilted, unfortunately there is not a rescue treatment. For the future, there are a number of options to reduce the impact of Root Rots and Damping-Off.

- Clean transplants with sterile seedling flats and potting soil
- Raised beds in the field to promote drainage
- Avoid heavier soils for peppers
- Use black plastic mulch to warm soil
- Wait to transplant peppers until soils approach 70°F
- Apply modest amounts of fertilizer; Cornell recommends 125 lbs N/ac applied in a divided fashion, weekly if possible.

Are there fungicides available? Yes, and first we suggest the incorporation of beneficial microbial products such as RootShied at planting to colonize the roots and rootzone, reducing the opportunity for Root Rot pathogens. There are a couple of soil applied conventional materials that can be applied as rescue treatments, early in an outbreak these include:

- Orondis Gold (FRAC groups 4 and 49), with a 7-day PHI, and prohibitions on other group 49 foliar applications. This prohibition on foliar applications of group 49 should not be a challenge for pepper growers in NYS, but could complicate vine crop and tomato spray schedules that might include other Orondis products.
- Previcur Flex (FRAC group 28), with a 5-day PHI, labeled for Pythium spp. This material is also an option for mixed produce growers battling Downy Mildew in vine crops or Late Blight in tomatoes and potatoes.

POTATOES

Colorado potato beetles remain active in low numbers in most fields. **Late blight has been reported in Cattaraugus County, NY and Spartansburg, PA this week** (see ALERT, page 2). Storms from Hurricane Debby will increase the chances of late blight spreading through the region. It is important to stay consistent with fungicide applications as we move into the end of the season. Please monitor fields and report any suspected late blight to a CVP Specialist for confirmation and to identify genotype. Late blight has also been reported in Maine and Tennessee this week. – ML

SQUASH

Another round of squash bug activity. Remember that these are best controlled as small insects shortly after hatch. Once they start resembling an adult squash bug, they are much harder to kill. Also starting to see some fruit rots beginning on winter squash. The cool, damp weather has been favorable for such diseases. – EB

SWEET CORN

Tar spot was confirmed in Niagara and Wyoming Counties this week. Please keep watch for this disease and report sightings to Elizabeth Buck or Julie Kikkert for confirmation. **Disease symptoms are small, raised, black spots that have a 'tarry' appearance and occur randomly across the upper and lower surfaces of the leaves.** The black spots are fungal structures that contain spores. The spots are typically 1/16th to 3/4th of an inch in diameter and typically extend through the leaf so that they can be viewed on both sides. These black spots can also appear on corn husks and leaf sheaths. In addition to the black spots, tan to brown lesions with dark borders ('fisheye') may also appear around the fungal structures. The black spots may be mistaken for older common rust pustules (which progress from orange red to black with age), or insect droppings. Insect droppings can be differentiated from tar spot by appearing on only one side of the leaf and may easily be scraped off. Tar spot cannot be scraped or washed off and are typically raised from the leaf surface. See the tar spot article in the 7/31/24 issue of VegEdge. – JK

Tar spot on sweet corn. *Photo (left): E. Buck, CVP. Photo (right): J. Kikkert, CVP*

Resistance to FRAC 7 Fungicides Detected in CVP Region

Highlights from 2023 Fungicide Trial and New Fungicide Recommendations for Alternaria Leaf Spot and Head Rot in Brassicas

Christy Hoepting, CCE Cornell Vegetable Program (reviewed by Chris Smart and Hirut Betaw, Plant Pathology and Plant-Microbe Biology, Cornell AgriTech

Summary

- **Fungicide resistance to Alternaria leaf spot (ALS) and head rot was detected to FRAC 7c in active ingredient (a.i.) boscalid**, which is the active ingredient in Endura.
- ALS is likely developing fungicide resistance to all FRAC 7 fungicide active ingredients.
- Fungicide resistance to FRAC 7c boscalid was detected on 6 out of 7 conventional vegetable farms in Erie, Genesee and Monroe Cos. in Fall of 2023.
- **Cornell is no longer recommending FRAC 7 fungicides for control of ALS and head rot in brassicas.**
- **Quadris Top** (FRAC 3 + 11) provided **best control of ALS and head rot** in fungicide trial and was the only treatment that resulted in >70% marketable broccoli heads under high disease pressure.
- **FRAC 11 was most effective** FRAC group for control of ALS and head rot.
- **FRAC 3 is suspected to be slipping**/ALS developing fungicide resistance.
- FRAC 9 and 12 are suspected to "be doing most of the work" in FRAC 3 and 7 premixes Inspire Super (3 + 9) and Miravis Prime (7a +12).
- Bravo (FRAC M5) failed to prevent head rot but reduced foliar ALS by 64% under high pressure.
- **Organic fungicides failed to prevent head rot under high pressure.**
- **Organic fungicide Oso 5% SC 6.5 fl oz/A (FRAC 19) provided best control of foliar ALS**, which was similar to Bravo.
- **Copper bactericides Kocide 3000-O and Cueva had some activity (18%, 40%) on foliar ALS**, but were not as good as Bravo or Oso.

Example Fungicide Spray Program for ALS and Head Rot in Broccoli (considering fungicide resistance to FRAC 7).
*Ideally, for best fungicide resistance management, there should be **no more than 2 apps per FRAC group per crop**, except FRAC M5 may be used more because it has a very low risk of fungicide resistance. Products with 0-1 day pre-harvest intervals (PHI) are saved for harvest.*

Week	Crop (Broccoli) Stage	Product and Rate/A	FRAC[1] Group(s)	PHI	Activity on Downy Mildew[2]
1-2	Pre-cupping	Bravo 1.5 pt	**M5**	7 days	Good
3	Canopy filled in	Inspire Super 20 fl oz	**3 + 9**	7 days	None
4	1" heads	Switch 14 oz	**12**	7 days	None
		-OR- Miravis Prime 11.4 fl oz	7[3] + **12**	7 days	None
5	2-4" heads	Quadris Top 14 fl oz	**3 + 11**	1 days	Not Labeled
6	harvest	Quadris 15.5 fl oz	**11**	0 days	Mediocre

1 **FRAC**: Fungicide Resistance Action Committee. Diseases may develop cross-resistance to active ingredients that belong to the same FRAC group.
2 **Best control of downy mildew** is provided by Orondis Opti/Ultra, Revus and Presidio.
3 If ALS has developed resistance to FRAC 7 fungicides, it is the FRAC 12 that "is doing most of the work" in this premix.

Fungicide "Cheat Sheet" for Alternaria leaf Spot and Head Rot in Broccoli and Other Cole Crops, 2024 is now available on the CCE Cornell Vegetable Program website, CVP. CCE.CORNELL.EDU, under Broccolli.

2023 Research Highlights

Summer trial with high disease pressure (Table 1) (Hoepting *et al. 2023*)

- Small-plot trial located at Cornell Agri-Tech research farm in Geneva, NY.
- 'Emerald Crown' broccoli, known to be susceptible to Alternaria leaf spot and head rot.
- Conventional and organic products tested in same trial.
- Trial planted on June 6. Raised beds covered in plastic mulch with drip irrigation, 2 rows spaced 1 ft apart on bed with 8 inches between plants.
- 5 weekly sprays from July 8 to August 2, initiated prior to disease detection.
- Trial artificially inoculated on July 13 and 20 when broccoli was beginning to head and had 1-inch heads, respectively. **A strain of *Alternaria brassicicola* collected from a conventional farm in Genesee Co. in NY in 2021 was used.** This strain was chosen because it was the most aggressive in Chris Smart's collection.

continued on page 7

continued from page 6

  - **Note, the broccoli ALS trials that were conducted at Agri-Tech in 2021-2022 were artificially inoculated with an ALS strain collected from a conventional farm in Monroe Co. in NY in 2018.**
- Broccoli heads harvested when reached marketable size on July 28, August 1 and August 8.
- Data collected: No. marketable heads (zero rot), severity of Alternaria rot in unmarketable heads (7-point scale), severity of foliar ALS as a 100% scale (August 10).
- Disease pressure was high. The nontreated had 0% marketable heads with moderate head rot severity and foliar ALS severity was 83%.
- The quality of this trial was EXCELLENT.

Marketable heads not possible with organic fungicides under high disease pressure

- Under high ALS pressure, organic fungicides resulted in only 1 to 10% marketable heads, which was not significantly different than the nontreated.
- Organic fungicides significantly reduced foliar ALS severity. Oso 6.5 fl oz/A (FRAC 19) was the best (61% control) (Fig. 1), followed by copper bactericides (FRAC M1) Cueva 0.5% v/v (40% control) and Kocide 3000-O 0.75 lb/A (18%).
- Oso was generally as good as Bravo, but not as good as a top-performing conventional fungicide. Both were effective at reducing foliar disease but failed to prevent Alternaria head rot (Fig. 1).
- Adding adjuvant Nufilm-P, increasing rate to 13 fl oz/A and tank mixing with Cueva did not significantly improve ALS control over Oso 6.5 fl oz/A alone.
- Carb-O-Nator (a.i. potassium bicarbonate) had no activity on ALS and head rot.

Organic products tested in Cornell trials that failed to control ALS (2021-2023):

- FRAC P06 – Lifegard (inconsistent performance), LPI6748 (pipeline product)
- FRAC BM02 - Double Nickel and Theia
- FRAC P05 – Regalia
- FRAC M2 – Microthiol Disperss
- a.i. potassium bicarbonate – Carb-O-Nator

Cornell does not recommend these products.

Table 1. Evaluation of organic and conventional fungicides for control of Alternaria leaf spot and head rot in broccoli (c.v. Emerald Crown), small-plot fungicide trial, Geneva, NY, 2023 (Hoepting *et al.*).

Product and Rate/A (A-E)[1]	FRAC[2] Group	3 d & 6 d post Spray D, 6 d post Spray E, 28 Jul, 1, 8 Aug (Harvest)				8 d post Spray E, 10 Aug (Harvest)	
		Marketable Heads (%/plot)		Mean ALS Head Rot Severity Rating[3] (0-6/head)		ALS Foliar Severity (%/plot)	
Untreated		0.0	e[4]	4.1	a	82.7	ab
Organic fungicides:							
Carb-O-Nator 5 lb/100 gal		1.8	e	4.0	ab	74.0	bc
Cueva 0.5% v/v	M1	1.3	e	3.3	bc	50.0	d
Kocide 3000-O 0.75 lb	M1	10.5	e	2.1	de	67.5	c
Oso 6.5 fl oz	19	8.1	e	2.4	d	32.4	efg
Oso 6.5 fl oz + Nu-Film P 0.125% v/v	19	9.3	e	2.8	cd	38.7	ef
Oso 13 fl oz + Nu-Film P 0.125% v/v	19	5.2	e	2.5	d	26.0	g
Oso 6.5 fl oz + Cueva 0.5% v/v	19 + M1	9.3	e	2.7	cd	42.5	de
Conventional fungicides:							
Bravo Weatherstik 1.5 pt	M5	11.8	de	2.1	de	29.7	fg
Inspire Super 20 fl oz + DA	3, 9	26.7	d	1.1	fg	0.6	h
Quadris Top 14 fl oz + DA	3, 11a[5]	71.6	ab	0.3	g	1.1	h
Inspire 7 fl oz + DA	3	3.1	e	2.4	d	4.4	h
Quadris 11 fl oz + DA	11a	56.4	bc	0.4	g	7.4	f
Miravis Prime 11.4 fl oz + DA	7a, 12	59.2	bc	0.5	g	6.7	h
Luna Sensation 7.6 fl oz + DA	7b, 11b	52.3	c	0.5	g	1.0	h
Velum Prime 3.8 fl oz + DA	7b	9.3	e	1.7	ef	4.4	h
Endura 9 oz + DA	7c	1.7	e	3.9	ab	89.0	a
p value (α = 0.05)		<0.0001		<0.0001		<0.0001	

1 **Treatment application dates: A** – 8 Jul; **B** – 14 Jul; **C** – 19 Jul (heading begins); **D** – 25 Jul (harvest begins); **E** – 2 Aug. **DA:** Dyne-Amic is a nonionic surfactant (NIS) with penetrating and spreading properties, which was used with conventional fungicides that have translaminar activity at 0.125% v/v. Nu-Film P is a NIS with spreading and sticking properties and is approved for organic use.

2 **FRAC**: Fungicide Resistance Action Committee.

3 **ALS Head Rot Severity Scale:** 0 - healthy; 1 - very minor; 2 - minor; 3 - minor-moderate; 4 - moderate; 5 - moderate-severe; 6 - severe.

4 Numbers in a column followed by the same letter are not significantly different, Fisher's Protected LSD Test, $p < 0.05$.

5 **a, b, c are codes for different active ingredients within the same FRAC group.** For FRAC 11: a - azoxystrobin; b - trifloxystrobin. For FRAC 7: a - pydiflumetofen; b - fluopyram; c - boscalid.

Quadris Top best in trial

- Under high disease pressure, **Quadris Top 14 fl oz/A (FRAC 3 + 11a) was the only treatment that resulted in more than 70% marketable heads (72%, Fig. 1)**. The unmarketable heads had very minor head rot (0.34 out of 7 scale) and foliar ALS severity was 1.1% (99% control compared to nontreated).
- Quadris Top had significantly more marketable heads than Quadris 11 fl oz/A (FRAC 11a) alone (56%).
  - Note that Quadris is labeled from 6 to 15.5 fl oz/A for ALS in brassicas. The 11 fl oz/A rate used in this trial was equivalent to the amount of active ingredient azoxystrobin applied in Quadris Top 14 fl oz/A, which is a premix of azoxystrobin + difenaconazole. **It is entirely possible that a higher rate of Quadris would have been as good as Quadris Top.**
  - There were no significant differences between Quadris Top and Quadris for severity of head rot or foliar ALS (Fig. 1).

FRAC 7 and 3 premixes also some of best treatments

- Luna Sensation (FRAC 7b + 11b, Fig. 1), Miravis Prime (FRAC 7a, 12) and Inspire Super (FRAC 3 + 9) provided very good to excellent ALS control.
  - Except that Inspire Super only had 27% marketable heads.

continued on page 8

continued from page 7

FRAC 7c boscalid in Endura failed, fungicide resistance suspected

- Endura (FRAC 7c) looked like an untreated check (Fig. 1) and was not significantly different than the untreated for % head rot, head rot severity or foliar ALS.
- Endura was one of the top performing fungicides in 2018 on-farm trial and when inoculated with an ALS strain from this farm in the 2021 Geneva trial, Endura was significantly better than Bravo, but not as good as the best treatment. In 2018 on-farm trial, Endura had 25% marketable heads (although very minor severity of rot) and reduced foliar ALS by 82% or more.
- Alone, the FRAC 7b fungicide in Luna Sensation (FRAC 7b + 11b), trialed as Velum Prime had 9.3% marketable heads, which was not significantly different than the untreated and 82% fewer than Luna Sensation. FRAC 7b alone had significantly more severe head rot than Luna Sensation, but less severe head rot than the untreated, and was not significantly different than Luna Sensation for foliar ALS severity (Fig. 1).
  - This result suggests that **ALS may also be developing fungicide resistance to FRAC 7b** and that it is likely the FRAC 11 in Luna Sensation that is "doing most of the work".
- The other FRAC 7 active ingredients, including 7a in Miravis Prime, 7b in Luna Sensation and 7d in Priaxor (7d + 11c) should also be tested for fungicide resistance.

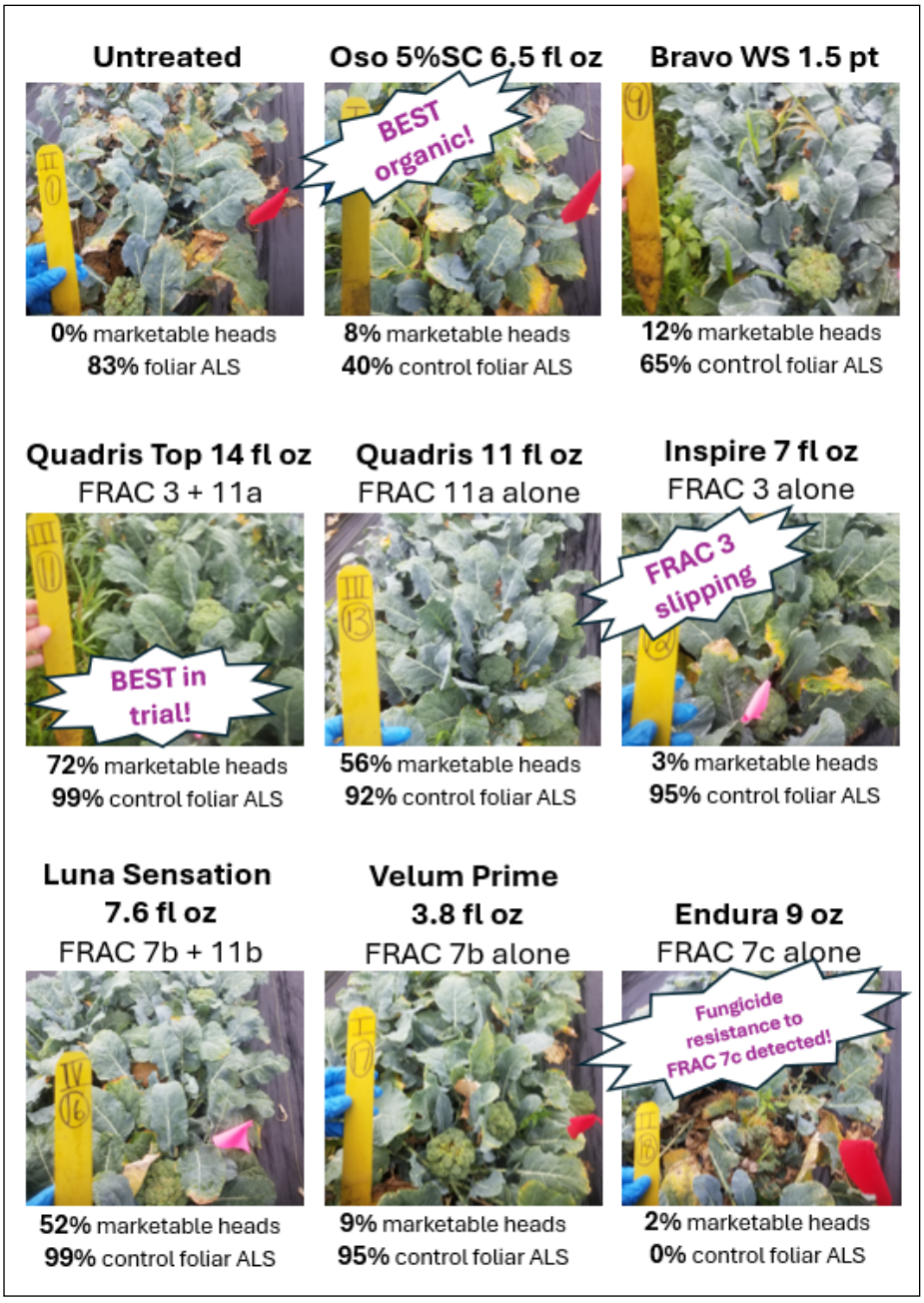

Figure 1. Evaluation of organic and conventional fungicides for control of Alternaria leaf spot and head rot in broccoli (c.v. Emerald Crown), small-plot trial, Cornell Agri-Tech, Geneva, NY, 2024. *Note, light-green foliage in Quadris Top and Inspire, due to difenaconazole.*

FRAC 7 fungicide resistance detected in CVP region

In Fall of 2023, the Smart lab (Betaw & Smart, 2023) conducted fungicide sensitivity testing to FRAC 7c boscalid on:

- **ALS isolates collected from the broccoli fungicide trial at Agri-Tech:**
  - 6 out of 6 (100%) ALS isolates collected from Endura treatments were resistant.
  - 2 out of 2 (100%) ALS isolates collected from Velum Prime (FRAC 7b) treatments were resistant. This means that there is cross-resistance between a.i.s FRAC 7c (boscalid) and 7b (fluopyram).
- **ALS isolates collected from 7 conventional and 1 organic vegetable farms in Erie, Genesee and Monroe Cos. in Fall of 2023 (Table 2):**
  - Fungicide resistance to boscalid was detected on 5 out of 7 (71%) of conventional farms, of which 31 out of 45 (= 69%) ALS isolates were resistant.
  - The ALS isolates collected from the site in Monroe Co. from where the ALS strain used to artificially inoculate the fungicide trials at Agri-Tech in 2021-2022 was resistant to boscalid in 2023. Endura was moderately effective (25% marketable heads) on this farm in 2018 and in the fungicide trials at Agri-Tech in 2021-2022. Since the grower used FRAC 7 fungicides to manage ALS from 2019 to 2023, **this suggests that ALS selected for 100% fungicide resistance in just 5 years.**

continued on page 9

continued from page 8

  - Interestingly, 60% of the ALS strains were resistant to boscalid on a farm where FRAC 7 fungicides were NEVER used to treat ALS. This suggests that there may be aerial movement of ALS strains that are resistant to FRAC 7 fungicides among farms within a county (or similar area).

- **Due to known development of ALS developing fungicide resistance to FRAC 7c, Cornell is not longer recommending FRAC 7 fungicides for managing ALS and head rot in brassicas.**

Table 2. Fungicide resistance status of *Alternaria brassicicola* to FRAC 7c boscalid (a.i. in Endura fungicide), collected from commercial vegetables farms in CVP region in Fall of 2023 (Betaw & Smart, 2023). *Note: Attempts were made to collect ALS isolates from conventional farms in Orleans and Wayne Cos. in Fall of 2023, but disease pressure was too low to obtain any viable isolates.*

NY County	Farm Type	No. ALS isolates tested	No. ALS isolates Resistant to boscalid
Erie	conventional	1	0
Erie	conventional	5	4
Erie	conventional	5	0
Erie	organic	4	0
Genesee*	conventional	4	4
Genesee**	conventional	10	6
Monroe***	conventional	10	9
Monroe	conventional	10	8
	TOTAL	**49**	**31 (= 63%) (= 69% conventional)**

* Site where ALS isolates were collected in 2021, which were used for artificial inoculum in trials at Agri-Tech in 2023 where Endura (a.i. boscalid) failed to control ALS and head rot.

** Site just 10 miles from "**Genesee***" where FRAC 7 fungicides had NEVER been used to manage ALS in brassicas.

*** Site where ALS isolates were collected in 2018, which were used for artificial inoculum in trials at Agri-Tech in 2021-2022. Note, 100% fungicide resistance was detected to FRAC 7c boscalid just 5 years after it performed well in fungicide trial in 2018.

FRAC 3 slipping in Quadris Top/Inspire Super, FRAC 9 and 11 doing "most of the work"

- We trialed the FRAC 3 a.i. difenaconazole in Quadris Top (FRAC 3 + 11a) and Inspire Super (FRAC 3 + 9) premixes alone (as Inspire).
- FRAC 3 alone was not significantly different than the untreated for marketable heads (3%), but had significantly less severe head rot severity, which was significantly more severe than Quadris Top/Inspire Super. There were no significant differences between FRAC 3 alone and Quadris Top/Inspire Super for foliar ALS severity (Fig. 1).
- These results suggest that ALS may also be developing fungicide resistance to FRAC 3 and that the FRAC 11 and FRAC 9 in these FRAC 3 premixes are likely doing "most of the work".
- FRAC 3 active ingredients should also be screened for fungicide resistance. There are three labeled for ALS in brassicas, difenaconazole, tebuconazole (in Viathon) and flutriafol (in Rhyme and Topguard EQ).
- It was observed that any treatment with difenaconazole (FRAC 3 in Quadris Top, Inspire Super and Inspire) turned the broccoli foliage from blue-green to light-green (Fig. 1).

Bravo mediocre for foliar ALS control, fail to prevent head rot under high pressure

- Since Bravo has a very low risk for fungicide resistance, we expect it continue to perform as well as it always has as "significantly better than nothing, but not great". Bravo is not as good as the best-performing treatments.
- This is also how Bravo did in 2023 trial for foliar ALS and head severity, but it was not significantly different than the untreated for % unmarketable heads (12%) under high pressure (Fig. 1).
- Addition of a plant defense activator (FRAC P06, LPI6748) to Bravo did not improve ALS control in 2023 trial (data not shown). ●

Sweet Corn Pheromone Trap Network Report

Marion Zuefle, NYS IPM, 8/13/24

Statewide, 29 sites reporting this week (see trap count table). European corn borer (ECB)-E was trapped at 3 sites and ECB-Z was trapped at 5 sites. Corn earworm (CEW) was trapped at 25 sites, with 22 sites high enough to be on a 4, 5 or 6-day spray schedule (see chart). Fall armyworm (FAW) was caught at eight sites and Western bean cutworm (WBC) was caught at 19 of the reporting sites. Both CEW and FAW increased over the last week.

Where FAW are being caught, a tassel emergence scout in late plantings is still a good idea, as some years we see heavy FAW infestations in the emerging tassels that may have time to get into developing ears before silk sprays for CEW.

Fields that are in whorl or early tassel stage should also be scouted for WBC egg masses with a 4% threshold for processing sweet corn and a 1% threshold for fresh market sweet corn. It takes between 5-7 days WBC eggs to hatch. It is critical that sprays are timed before the larvae have a chance to enter the ear. The egg mass will become purple in color approximately 24 hours before egg hatch. Here is a video from Purdue on scouting for WBC egg masses and larvae. ●

Do Vegetables Need Extra Boron?

Steve Reiners, Horticulture, Cornell University, Cornell AgriTech

[I have had several questions about boron this season and was recently reading reports from other areas about boron deficiencies showing up in cole crops and beets. Dr. Reiners sent me this article which provides a good overview. He provided additional information that soils would be considered low in boron at less than 0.35 pounds/A with a medium range being 0.36 to 0.75 lb/A and greater than 0.75 lb/A considered high. Those levels are when soil is analyzed using a Morgan or Modified Morgan test. – ed. J. Kikkert, CVP]

Vegetable growers seem to have a lot of interest in using boron (B) fertilizers. Boron is an essential plant nutrient, which means plants cannot complete their life cycle unless boron is present in the soil. But unlike essential nutrients like nitrogen, phosphorus and potassium that are needed in large amounts (>100 pounds/A), only small amounts of boron are needed, in the range of 1-3 pounds of boron per acre.

Even that amount varies by crop. Some crops truly benefit from boron additions and others not so much. For crops like beans and peas, excess boron can cause toxicity. Table 1 provides details on likely vegetable crop responses to boron.

Table 1. Vegetable response to applied boron and recommended application rates.

	High B Requirement 3 lbs/A	Medium B Requirement 2 lbs/A	Low B Requirement 1 lb/A	No B Requirement 0 lbs/A
Vegetable Crop	Beets Broccoli Cabbage Cauliflower Celery Kale Rutabaga Spinach Swiss chard Turnip	Asparagus Carrots Cucurbits Eggplant Leeks Onions Parsnips Potatoes (white) Radishes Sweet corn Tomatoes	Potatoes (sweet) Peppers	Beans, all Peas

What conditions are most likely to cause a boron deficiency?

Very sandy soils, low in organic matter and alkaline soils with a pH above 7 can be the most problematic. But droughty conditions or soils very high in calcium can also cause deficiencies. Like calcium, boron is absorbed by plant roots and moves through the transpiration stream. If you are an organic crucifer grower and maintain a soil pH above 7.2 to control club root, a boron deficiency is likely in susceptible crops.

What are typical boron deficiency symptoms?

It depends on the plant. Growing points can die back, which can be a very common symptom in beets. Also in beets, roots can develop internal black rings. In crucifer crops, typical deficiency symptoms include cracked or corky stems. Broccoli and cauliflower stems are hollow and brown internally.

Boron Application

Crucifer crops, beets and celery are the most likely crops to respond to boron applications. Applications to crops with a medium and low requirement are less likely to result in noticeable differences. That is especially true if fields are at the optimum soil pH. A few years ago, there was some discussion that boron could improve yields and quality of tomatoes, but additional research has not shown that to be the case.

Boron can be applied as a broadcast application with other fertilizers in the spring or as a foliar application later in the spring. Remember to adjust your boron application based on the material being used. The rates suggested in Table 1 are actual pounds of boron per acre. If you want to add 1 pound of actual boron per acre and you are using Borax that contains 11% B, you will need about 9 pounds of Borax (1 ÷ 0.11 = 9.09). If using Solubor at 20% B, you would need only 5 pounds of Solubor (1 ÷ 0.2 = 5).

I'm not a big proponent of foliar nutrient applications. But boron, like many of the micronutrients, can be effective when applied in this manner. It is especially helpful on a high pH soil that may tie up boron and make it unavailable through root uptake. If using foliar applications, rates should be reduced significantly to reduce toxicities, with rates of only 0.1 to 0.3 pounds per acre of actual boron applied. It is best to apply in at least 30 gallons of water per acre. Another advantage of the lower rate with foliar applications is less likelihood of boron toxicity if beans or peas are in rotation.

If using a foliar application, apply either early in the morning or in the evening when humidity is high, and leaves will stay wetter. Do not apply when plants are drought stressed. Apply when temperatures are below 80°F. Optimum temperature for foliar application is 72°F. Spray when winds are calm to avoid drift and use smaller droplet size to maximize uptake. ●

Upcoming Events

Chipping Potato Twilight Meeting

August 20, 2024 (Tuesday) | 5:00 pm - 6:00 pm
Mahany Farms, 10046 NY-36, Dansville, NY 14437

Join us for a brief, on-farm meeting including insect pest updates and viewing of the chipping potato variety trial. 1.0 DEC credits in categories 10, 1a, and 23 will be offered. Dinner follows!

FREE! No pre-registration required. See the agenda online.

Cornell Vegetable Variety Showcase and Pathology Twilight Meeting

August 21, 2024 (Wednesday) | 5:00 pm - 8:00 pm
Homer C. Thompson Vegetable Research Farm, 133 Fall Creek Rd, Freeville, NY 13068

The event will include tours of commercial variety trials and Cornell breeding plots for tomato, pepper, squash, cucumber, and potato, as well as a vegetable disease field walk, variety tasting, and dinner. 1.75 DEC credits in categories 10, 1a, and 23 offered.

FREE and open to the public! Free dinner will be provided.
See the schedule, speakers, and register online by August 14 at https://cals.cornell.edu/cornell-vegetable-variety-showcase-and-pathology-twilight-meeting

Regional Agritourism Networking Session

August 26, 2024 (Monday) | 12:00 ppm - 4:00 pm
Wickham Farms, 1315 Sweets Corners Rd, Penfield, NY 14526

Agritourism is a growing niche of tourism. At this event hosted by CCE Monroe and CCE Erie, experienced agritourism operators will discuss the best practices and opportunities that agritourism can bring to your farm. You will be able to connect with tourism agencies and learn about the resources available through your Extension and Cornell's Agritourism Program Work Team. This newly established state-wide outreach Team will also facilitate discussions and connections to the national agritourism network.

Speakers:

- Jarmila Haseler & John Whitney, CCE – Welcome
- Bill Wickham, Wickham Farms – Introduction
- Greg LaDuca – Visit Rochester Support
- Sara Emmert, NYS Division of Tourism - I LOVE NY Representative
- Amy Machamer, Hurd Orchards – Sharing an Agritourism Model That Works for Them
- Laura Biasillo, CCE Broome – Agritourism Resources & Networking Dialogue
- Wickham Farms Sstaff – Facility tour and continued dialogue

COST: $12 per person, includes lunch. Additionally, you can enter a raffle to win a prize. Each raffle ticket includes a 10% discount to the Taste NY Markets in Western NY and Finger Lakes Welcome Centers who generously donated the raffle baskets.

REGISTER by August 22: https://tinyurl.com/5n6m3sd6

Cornell Cooperative Extension
Cornell Vegetable Program

480 North Main Street
Canandaigua, NY 14424

VEGEdge
YOUR TRUSTED SOURCE FOR RESEARCH-BASED KNOWLEDGE

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VegEdge is the highly regarded 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 University 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

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