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OMAFRA Vegetable Team:

Travis Cranmer, Guelph
519-835-3382
travis.cranmer@ontario.ca

Dennis Van Dyk, Guelph
519-766-5337
dennis.vandyk@ontario.ca

Elaine Roddy, Ridgetown
519-401-5890
elaine.roddy@ontario.ca

Amanda Tracey, Ridgetown
519-350-7134
amanda.tracey@ontario.ca

"In This Issue"

Using fungicides for Stemphylium leaf blight in onions

Stemphylium leaf blight (caused by a fungus, *Stemphylium vesicarium*) of onion was first identified in Ontario in 2008 and has since become the most economically important disease in onions. The main management method for this disease is regular applications of foliar fungicides. However, many products are no longer effective against this fungus due to fungicide resistance. This is putting more pressure on the remaining effective fungicides. Growers should be aware that some fungicides that they have relied on for managing Stemphylium leaf blight may no longer be effective.

Stemphylium leaf blight starts as yellow-tan, water-soaked lesions that develop into elongated brown to black spots (**Figure 1b**). As the lesions grow, whole leaves will die back, and plants lose their photosynthetic ability. Onion leaves may die prematurely resulting in a reduced yield. Additionally, onions going into storage are typically sprayed with a sprout inhibitor before lodging. Plants need five to seven green leaves to take up the sprout inhibitor. If Stemphylium leaf blight kills most of the leaves, then sprout inhibitor cannot be applied, resulting in reduced storage and shelf life.

Early in the season, the symptoms of purple blotch, caused by *Alternaria porri*, look similar to those of Stemphylium leaf blight. Purple blotch lesions are tan to white with purple centers, while Stemphylium leaf blight causes tan lesions with black centers (**Figure 1A**). Botrytis leaf blight, caused by *Botrytis squamosa*, also causes lesions on onions but are easier to distinguish as they are smaller and irregular in shape with a greyish/white appearance (**Figure 1C**).

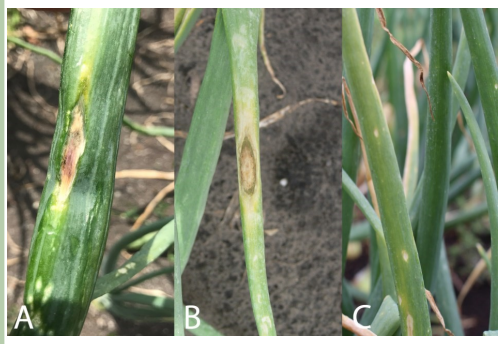

Figure 1. Onion with **A)** Purple blotch lesion, **B)** Stemphylium leaf blight lesion, **C)** Botrytis leaf blight.

Using fungicides for Stemphylium leaf blight in onions…con't

Stemphylium vesicarium spores are dispersed by wind and spores are present throughout the entire onion growing season, with spore counts increasing during the season. Stemphylium leaf blight lesions generally appear at the end of June to mid-July and continue to develop during warm temperatures with adequate rainfall or irrigation until harvest. *Stemphylium vesicarium* also causes purple spot in asparagus.

Annual fungicide efficacy trials conducted on Stemphylium leaf blight by the Ontario Research Station -Bradford (formerly the Muck Crops Research Station) in the Holland Marsh have shown reduced efficacy of many fungicides since 2013. *Stemphylium vesicarium* can develop resistance to fungicides over short periods of time. Populations of resistant fungi are selected for by repeated use of products with the same mode of action. In a field, the fungal population is quite variable, and some individuals can be more tolerant to the fungicide. These resistant individuals can survive the application of fungicides, reproduce and pass on their resistant trait. These traits are called mutations. As the frequency of resistant mutations increase in the field, fungicides become less effective. The main fungicides for management of Stemphylium leaf blight in onions have been in the FRAC (Fungicide Resistance Action Committee) groups 3, 7, 9 and 11. Fungicides fall within the same group when they have a similar target site in the pathogen.

Recent research out of Cornell University and the University of Guelph have detected populations of *S. vesicarium* in onion fields with reduced sensitivity to FRAC groups 9, 11 and now, group 7 fungicides. All products labeled for use in Canada for Stemphylium leaf blight contain at least one of these fungicide groups. Approximately 50 samples were collected from 2018 and 2019 across the main onion growing regions in Ontario, and 90% were insensitive to azoxystrobin (group 11) and 57% were insensitive to pyrimethanil (group 9) in laboratory sensitivity studies. In 2020 samples, this increased to where there was at least 90% resistance to both fungicides. In New York, multiple resistance genes have been detected for group 7 fungicides, and as a result, some group 7 fungicides might be more effective than others. Reduced sensitivity in laboratory and field studies to the group 7 fungicides boscalid, fluopyram and fluxapyroxad have all been seen in New York. Until we better understand our local population, growers should use caution when relying solely on these FRAC groups for management of Stemphylium leaf blight.

Table 1. Registered products listed in OMAFRA's Vegetable Crop Production Guide, 2021 (omafra.gov.on.ca/english/crops/pub838/pub838.pdf)

Table 1. Stemphylium Leaf Blight Disease Management — Onion, Leek and Shallot
For resistance management, rotate between fungicides from different chemical groups.
LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
STEMPHYLIUM LEAF BLIGHT					
SDHI (group 7)	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	**Onions, leeks and shallots. Suppression.** Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
	benzovindiflupyr	Aprovia	750 mL/ha (304 mL/acre)	7	**Suppression.** Do not make sequential applications of any group 7 fungicide.
SDHI/ DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	7	**Bulb onion. Suppression.** Do not make sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
SDHI/AP (group 7/9)	fluopyram/ pyrimethanil	Luna Tranquility	1,200 mL/ha (486 mL/acre)	7	**Onions, leeks and shallots. Suppression.** Do not make sequential applications of any group 7 or group 9 fungicides. See label for restricted entry intervals.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	**Onions, leeks and shallots. Suppression.** Do not use on areas treated with product the previous season. Do not make sequential applications of any group 3 or group 11 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.

Certainly, there are other foliar diseases present in an onion field such as Botrytis leaf blight and purple blotch and these fungicides can still be effective on these diseases. When using fungicides, follow these best management practices to reduce resistance development;

- Use fungicide groups in rotation.
- Where possible, incorporate effective broad-spectrum, multi-site fungicides (group Ms such as chlorothalonil or mancozeb) as well as biofungicides as these have a low risk of resistance development.
- Limit the number of total applications per season per FRAC group.
- For group 7 fungicides, if using a solo formulation such as Sercadis or Aprovia, apply in strict alternation with other fungicide groups and only use in 1/3 of total applications.
- Luna Tranquility and Quadris Top are mixtures (see table 1), but only one group in each of these products is effective against Stemphylium leaf blight, so these should be treated as solo products.
- When using a group 7 in a mixture (such as Miravis Duo or tank mixing a solo group 7 with mancozeb), do not make more than 50% of your applications with group 7 containing fungicides.
- Avoid using a group 7 as the first foliar application if the seed was treated with a group 7 (such as Pen 240FS).
- Start applications early, before the disease becomes severe the crop. Research from Michigan State University has shown that starting fungicide applications at the 3-4 and 5-7 leaf stage were more effective than starting at the 8-12 leaf stage.

Using fungicides for Stemphylium leaf blight in onions…con't

Research conducted in the Holland Marsh has shown onion cultivars have varying degrees of susceptibility to Stemphylium leaf blight, however all onion cultivars are susceptible. Other cultural management strategies include limiting the leaf wetness period by irrigating in the early morning and allowing the crop to dry out as soon as possible to avoid prolonged periods of leaf wetness. Always remove or bury cull piles and bury leaf debris from the harvested crop as soon as possible. As with any other foliar disease of onion, it is beneficial to rotate with non-host crops for a minimum of three years. While this may not be practical in muck growing regions with a high density of onion fields, such as the Holland Marsh, longer crop rotations can help in reducing spore load.

Stemphylium leaf blight continues to be a challenging disease to control for onion growers. Disease forecasting shows promise for better timed fungicide applications, but more research is needed and is on-going. Continue to use all cultural methods to reduce disease severity and follow resistance management guidelines when using fungicides. On-going research into fungicide resistance will allow for better recommendations in future years. Follow ONVegetables.com for up-to-date information about Stemphylium leaf blight of onions and other vegetable-related news.

References

1. Hay, F., Sharma, S., Hoepting, C., Strickland, D., Luong, K., & Pethybridge, S. (2019). Emergence of Stemphylium Leaf Blight of Onion in New York Associated With Fungicide Resistance. Plant Disease, 103(12), 3083–3092. https://doi.org/10.1094/PDIS-03-19-0676-RE
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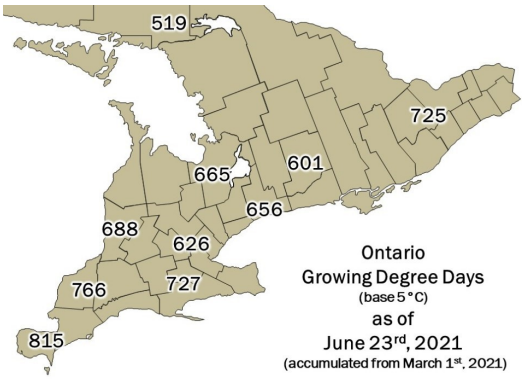
5. Fungicide Resistance Action Committee, SDHI resistance management recommendations. https://www.frac.info/frac-teams/working-groups/sdhi-fungicides/recommendations-for-sdhi

VCR – Vegetable Crop Report – June 24th, 2021

The VCR (vegetable crop report) is a weekly update which includes crop updates, weather and growing degree summaries for various vegetable growing regions across Ontario.



Temperature – Day time temperatures are forecasted to range from mid to high twenties in most regions.

Nighttime temperatures are forecasted to range from high teens to low twenties for most regions. The Growing Degree Day models for most regions continue to have a similar growth rate as their respective 10-year averages but are still ahead of the average by roughly 100 degree days.

Rainfall – Most regions are forecasted to have rain over the weekend and into next week. June continues to be a great month for precipitation with many regions being relatively close to their 10-year averages. However, Essex is the only region that has surpassed its 10-year precipitation average for the month of June.

Crop Updates

Asparagus – Most asparagus is completing harvest. Scouting for insects and diseases during fern establishment is very important.

Brassica Crops – Early cabbage and broccoli are close to harvest. Lepidopteran pests such as diamondback moth and imported cabbage worm continue to be high in pressure. Flea beetle pressure has decreased in most areas while the pressure of thrips may increase as hay is cut. Now that some areas have had a significant amount of moisture, be on the lookout for Alternaria and downy mildew. Dig up wilted plants with a trowel or shovel and inspect the roots. Wilting can be caused by several pest/pathogens including cabbage maggot, nematodes, clubroot, or wireworm damage. In new transplants continue to monitor for cutworms or heat canker.

Carrot – Early planted carrots are sizing up nicely. Carrot weevils should be wrapping up egg-laying in most areas of the province now, if you have some later planted carrots they may avoid most of the pressure.

Celery – Carrot weevils are active. On celery, carrot weevils leave scratch marks along the stalk that turn a yellow/orange colour as the wounds heal. Continue to scout for tarnished plant bugs and aster leafhoppers. Scout for Aster yellows and celery leaf curl (**Figure 1**.) and rogue out infected plants. Plants showing symptoms this early in the season will be a source of inoculum for infections later in the season.

Figure 1. Celery leaf curl causing downward cupping of leaves on establishing transplants in 2017.

Cucurbits – Since the identification of downy mildew in cucumbers in Kent county last week, there have been no further fields identified with the disease. Angular leaf spot has been found in zucchini and pumpkin. ALS is a bacterial disease and fungicides will not impact its spread. Fortunately plants usually seem to outgrow the damage. Keep an eye out for cucumber beetles. The threshold is 0.5 to 1 beetle per plant.

Garlic – Scaping is wrapping up and many fields are showing leaf tips starting to senesce. Tip dieback (where yellowing/ senesce starts at the tip and moves towards the heart of the plant) is likely due to stress which could be from lack of soil moisture, lack of or surplus of nutrients or root dieback. Quick leaf yellowing (where the whole leaf turns yellow) from the bottom leaves moving upwards can result from Fusarium basal rot, bulb and stem nematode (**Figure 2**.), or other damage to the roots. Leaf yellowing from the top, newest leaves and progressing downward is often caused by Aster Yellows, nitrogen deficiency, Fusarium yellows or herbicide damage. The amount of leek moth captures has increased in several regions. A single insecticide application is most effective when it is applied 10 days after the date that corresponds to the peak moth capture. If you plan on two applications, make the first application 3 to 7 days after the date of peak moth capture and the second treatment 14 days later. Products such as Matador, Delegate, Entrust, Success, Dipel, XenTari and Bioprotec are most effective when they make contact with the larvae.

Figure 2. Various degrees of bulb and stem nematode damage on garlic. Look for stunted plants with leaf yellowing from the bottom leaves of the plant moving upward.

Onions – Be on the lookout for onion downy mildew as some areas may have received conducive weather for sporulation and infection. Stemphylium leaf blight is likely to develop over the next couple of weeks (**Figure 3**). If Penflufen was part of the seed treatment, do not start with a foliar group 7 fungicide. For the first application, a product containing mancozeb (group M3) may provide protection. Mancozeb products such as Manzate Pro-Stick, Dithane Rainshield, and Penncozeb 75 DF Raincoat are registered for Botrytis and Manzate Pro-Stick is registered for Botrytis and Alternaria/Purple Blotch. Avoid applying products from the same chemical group one after the other. For the second foliar product, products containing group 7 show the best efficacy, such as Secadis, Aprovia, or Miravis Duo (group 7/3). Research has shown that there is very high resistance in Stemphylium to one of the fungicides in Quadris Top (group 11/3) and in Luna Tranquility (group 7/9). Follow a group 7 fungicide with T-77 or Bravo. While scouting, dig up wilted plants and look for maggots (**Figure 4**.), wireworms or pink root. The pressure of thrips is building. Past research has shown that Movento 240 SC (group 23) has some residual activity that works better against larvae when it is applied earlier in the season. If the spray threshold exceeds 3 thrips/leaf, Movento 240 SC could be followed by two applications of Delegate (group 5) or Agri-Mek (group 6). Malathion 85E (group 1B), Dibrom (group 1B), Entrust (group 5), Success (group 5), and Exirel (group 28) are also registered. Using a penetrating surfactant can be useful to maximize the effectiveness of products against thrips. Apply no more than two consecutive insecticides from the same IRAC crop as thrips have a relatively short life cycle with multiple generations through the summer months and are at a high risk of developing insecticide resistance. Botrytis leaf blight and onion smut has been observed in some regions.

Figure 3. Onion leaf with Stemphylium or Alternaria spores causing black spotting in tan lesion – June 24, 2020.

Figure 4. Onion maggot larvae. Alexandra Switzer, June 23, 2021.

Potatoes – Colorado Potato Beetle larvae are hatching and feeding in most areas of the province (**Figure 5**.). Time sprays to hit early instars if you are going to use a foliar application. Don't use a Group 4 insecticide (Clutch, Assail, Actara, Admire) foliar spray if you applied Cruiser, Actara, Titan or Admire at seeding. Symptoms of blackleg (**Figure 6**.) are evident right now as the plants will be wilted and dying. Seeing lots of tarnished plant bugs this year (**Figure 7**. **and 8**.). Be mindful of flushes of leafhoppers entering potato fields as there are lots of first cuts going on right now.

Figure 5. Colorado Potato Beetles as eggs, feeding instars, and molting larval instars
https://i0.wp.com/onvegetables.com/wp-content/uploads/2021/06/20210615_123640-1.jpg?resize=1024%2C768&ssl=1

Figure 6. Blackleg damage on potato plants

Figure 7. Tarnished Plant bug on potato leaf – June, 2021

Figure 8. Tarnished plant bug feeding damage – June, 2021

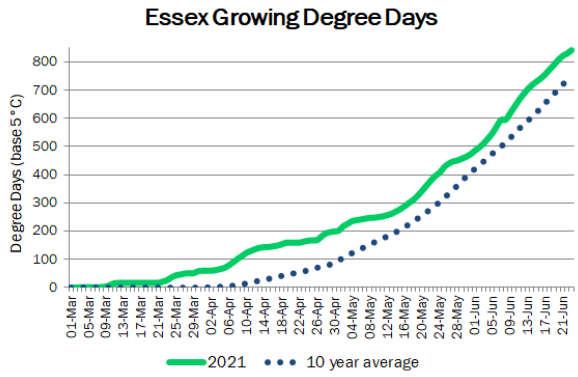
Pest Degree Day Forecasting
*NOTE: Data as of June 3rd, 2021

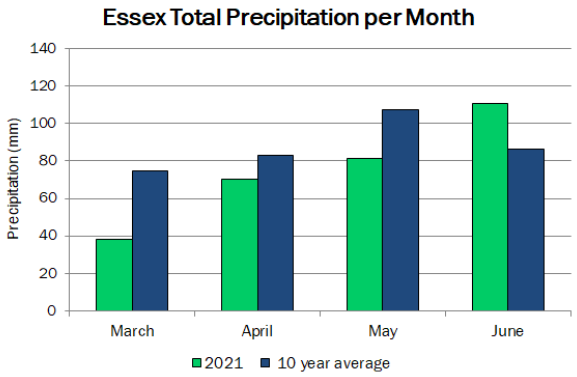
Pest	Carrot Rust Fly	Onion Maggot	Carrot Weevil	Aster Leafhopper	Tarnished Plant Bug	Cabbage Maggot	Seedcorn Maggot	European Corn Borer
THRESHOLD	329-395, 1399-1711	210-700, 1025-1515	138-156, 455+	128+	40+	314-398, 847-960, 1446-1604	200-350, 600-750, 1000-1150	See legend below
Essex*	1032	936	**664**	**517**	**347**	749	936	455
Chatham-Kent*	948	854	**603**	**465**	**277**	680	854	404
Norfolk**	899	809	**566**	**431**	**254**	642	809	371
Huron***	855	770	**544**	**418**	**246**	612	770	363
Wellington**	795	**708**	**483**	**359**	**199**	552	**708**	305
Simcoe County***	843	753	**516**	**389**	**226**	588	753	334
Durham***	826	**738**	**497**	**378**	**214**	569	**738**	326
Peterborough	773	**683**	449	**330**	**178**	519	**683**	278
Kemptville***	899	809	**554**	**413**	**236**	634	809	355
Sudbury***	662	588	401	**306**	**168**	457	588	262

*- Bivoltine region for ECB. First Peak Catch: 300-350 DD, Second Peak Catch 1050-1100 DD
**- Overlap region for ECB. First Peak Catch : 300-350 DD Second Peak Catch 650-700 DD, Third Peak Catch 1050-1100 DD
***-Univoltine region for ECB. Peak Catch 650-700 DD

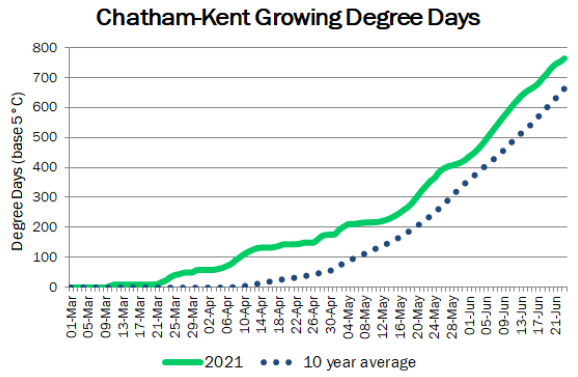
Use these thresholds as a guide, always confirm insect activity with actual field scouting and trap counts.
Select a region below for the latest weather, crop and pest degree day information:
Essex County(https://onvegetables.com/2021/06/24/vcr2021-6/#essex)
Chatham-Kent County(https://onvegetables.com/2021/06/24/vcr2021-6/#chatham-kent)
Norfolk County(https://onvegetables.com/2021/06/24/vcr2021-6/#norfolk)
Huron County(https://onvegetables.com/2021/06/24/vcr2021-6/#Huron)
Wellington County(https://onvegetables.com/2021/06/24/vcr2021-6/#wellington)
Simcoe County(https://onvegetables.com/2021/06/24/vcr2021-6/#simcoe)
Durham County(https://onvegetables.com/2021/06/24/vcr2021-6/#durham)
Peterborough(https://onvegetables.com/2021/06/24/vcr2021-6/#peterborough)
Kemptville(https://onvegetables.com/2021/06/24/vcr2021-6/#kemptville)
Sudbury(https://onvegetables.com/2021/06/24/vcr2021-6/#sudbury)

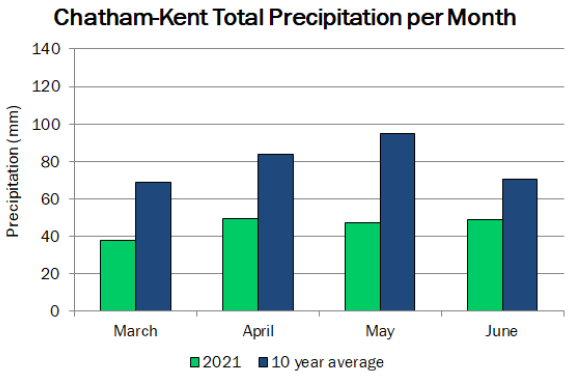
Essex County



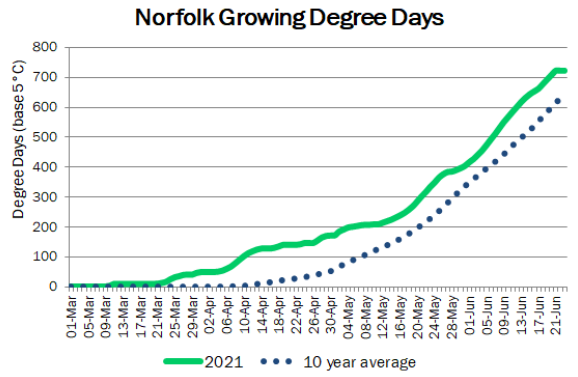


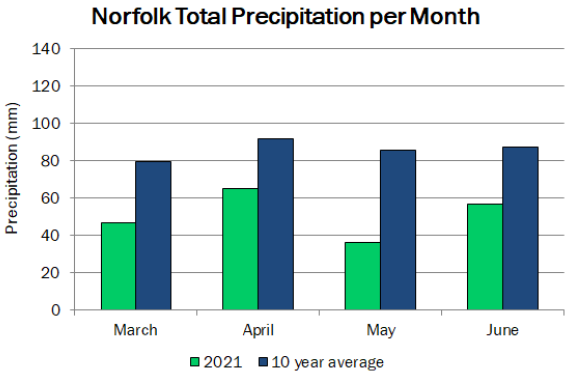
Chatham-Kent County



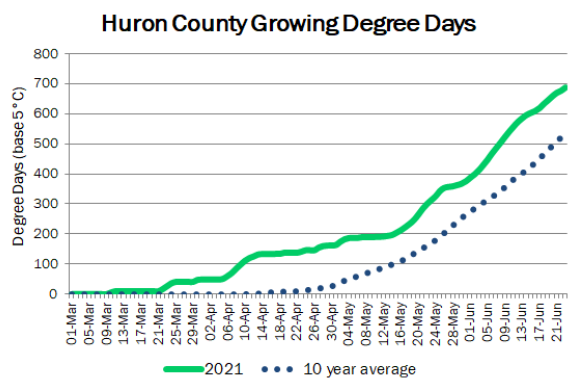


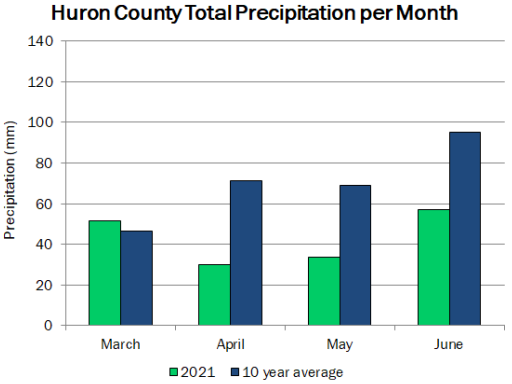
Norfolk County





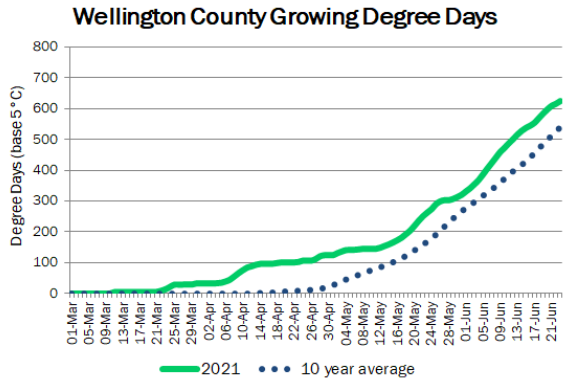
Huron County

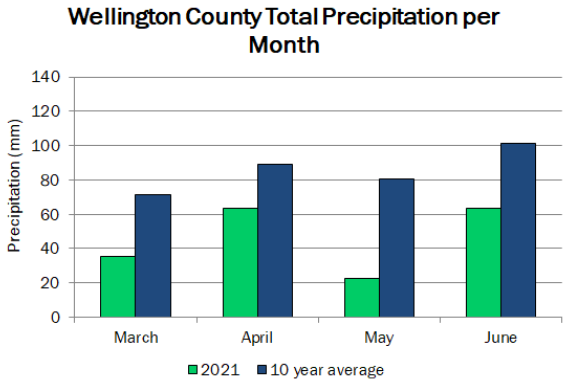




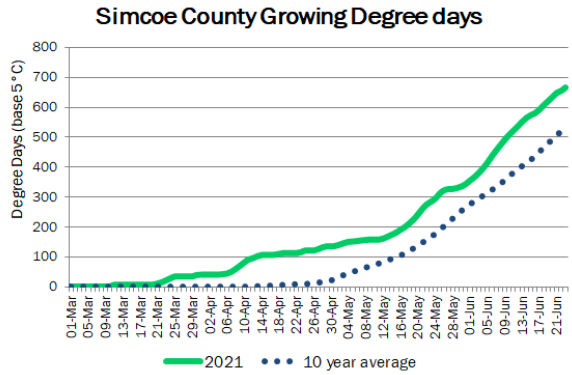
VCR – Vegetable Crop Report – June 24th, 2021…con't

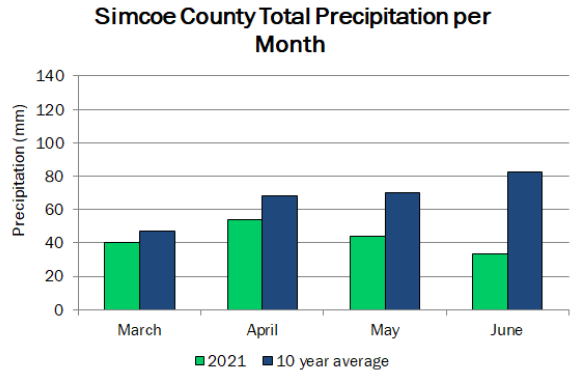
Wellington County



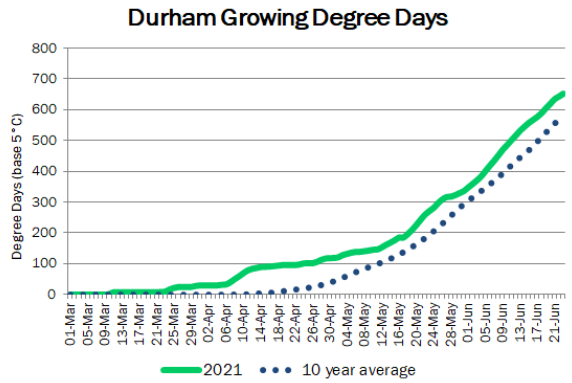


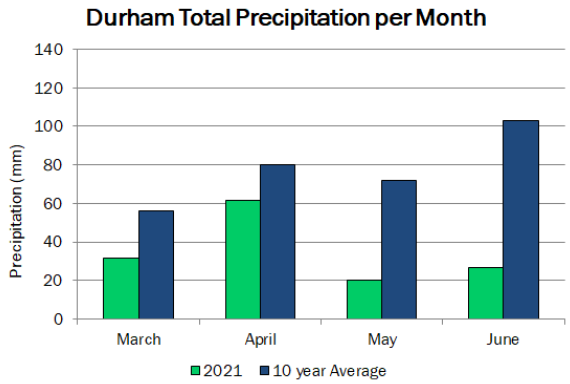
Simcoe County



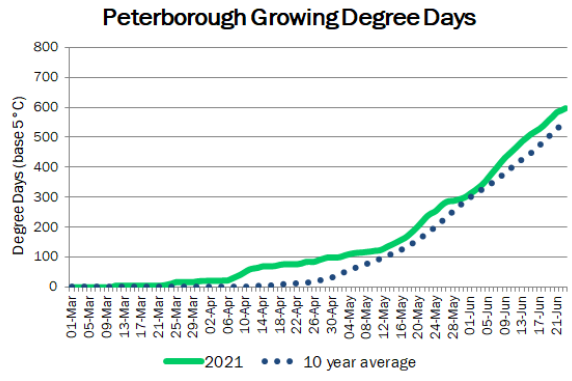


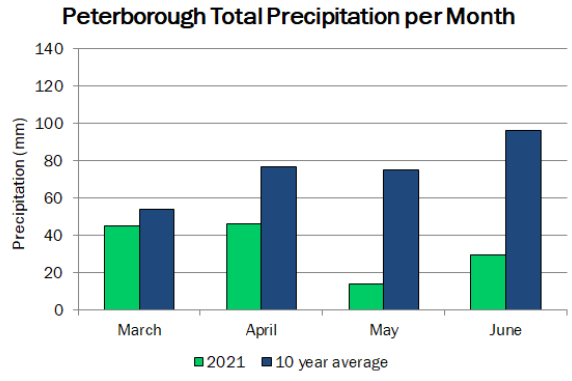
Durham County



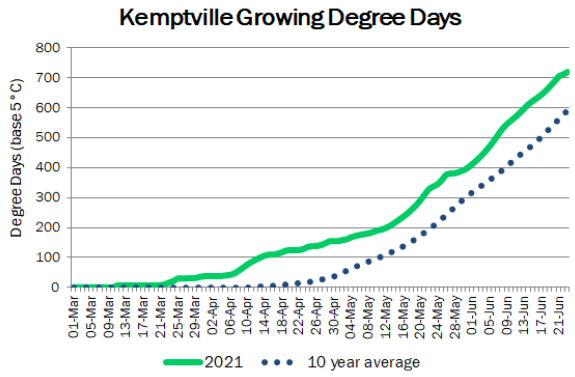


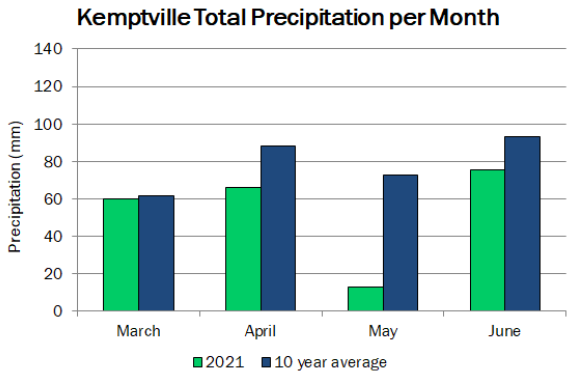
Peterborough



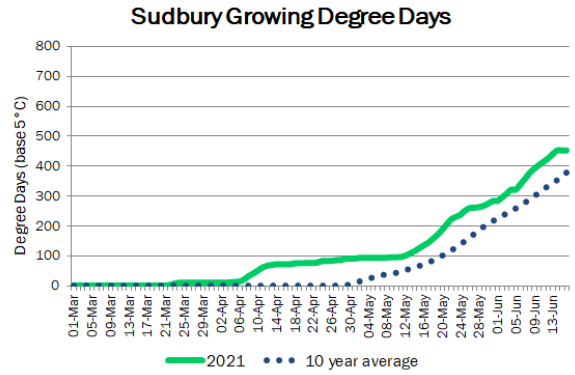


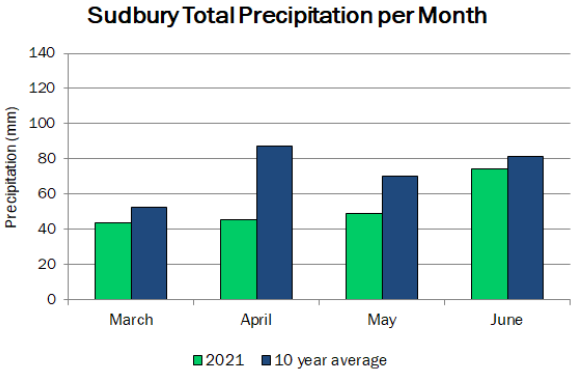
Kemptville





Sudbury





Spore traps monitoring for causal agents of tomato late blight and cucurbit downy mildew in Kent, Elgin and Norfolk Counties

Joseph Tomecek (Tomecek Agronomic Services/M.Sc. candidate, Dept. of Plant Agriculture, Univ. of Guelph); Elaine Roddy (OMAFRA), Amanda Tracey (OMAFRA), Dr. Cheryl Trueman (Ridgetown Campus, Univ. of Guelph)

Late blight, caused by the Oomycete pathogen *Phythophthora infestans, is a devastating disease of tomato and potato*. Another oomycete pathogen, *Pseudoperonospora cubensis*, causes cucurbit downy mildew, a significant disease of cucumbers and cantaloupe. The appearance of both of these diseases in Ontario can be sporadic, with symptoms first reported anywhere from late June to late August. This has made it difficult for growers to know when to modify fungicide programs to account for increased risk of these oomycete diseases.

To better understand if spore trapping is a useful tool to better predict risk of these diseases, spore trapping networks have been deployed in Kent and Norfolk counties this year. A network of spore traps has been set up at 15 locations across the tomato and cucumber growing regions of Kent, East Elgin and Norfolk counties. In Kent County, two types of traps are being tested. The first is a Spornado, which passively captures are particles through a mesh lined cassette placed inside a horizontal funnel. The second trap, called a Rotorod, spins silicone-coated plastic rods in the air to actively capture air particles. The cassettes and rods are collected twice-weekly for testing of pathogen DNA. In Norfolk County, only the Spornado trap is being deployed.

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Figure 1. Rotorod and Spornado spore traps at Ridgetown Campus, University of Guelph.

Figure 2. Rotorod trap at Ridgetown Campus, University of Guelph

Late blight (*Phytopthora infestans*)

This is the 2nd year of a three-year project to assess the value of different spore traps and forecasting models to better predict late blight risk. We are comparing the Spornado and rotorod spore traps at eight sites in Kent County, including a comparison of trap height at four of these location (Fig. 1). Three of these locations include unsprayed sentinel plots of tomatoes that are being monitored for first appearance of late blight. The BliteCast forecasting model, first developed in New York State is also being evaluated to indicate late blight risk based on environmental factors.

To determine if there is a benefit of spore traps or BliteCast, we are comparing fungicide program modifications based on the current high-risk trigger (late blight reported in the Great Lakes Region) to modifications based on detections in a spore trap, the BliteCast threshold, or both, in field trials at Ridgetown Campus and the Cedar Springs Research Station.

So, what is the risk of late blight so far this year?

- No positive detections of *P. infestans* spores in Spornado or rotorod traps, which were installed June 7 in either Kent County or Norfolk County.
- As of June 18, the BliteCast forecasting model has hit the threshold (18 DSV) for the first fungicide application at Cedar Springs but not yet at Ridgetown Campus (16 DSV as of June 28).
- There are no reports of late blight on tomato or potato in Ontario or anywhere in the Great Lakes Region.
- Taken together, the above points mean that the environment has been conducive for infection by *P. infestans*, but so far, we have no evidence that there is an active source of inoculum present in the growing region.

If you suspect late blight in your tomato (or potato) crop, please reach out to Amanda Tracey (amanda.tracey@ontario.ca, 519-350-7134) or Cheryl Trueman (ctrueman@uoguelph.ca, 226-971-0654) to confirm the diagnosis.

Cucurbit downy mildew (*Pseudoperonospora cubensis*)

If left untreated, cucurbit downy mildew can cause yield losses of up to 100% in cucumbers. The current management strategy involves a broad-spectrum fungicide program during the early season, switching to targeted downy mildew fungicides as soon as downy mildew is identified anywhere in the Great Lakes basin.

We are testing for downy mildew in the 3m tall Spornado traps at all 15 locations. In Elgin and Norfolk, five traps are located in commercial cucumber fields, one trap is in a commercial tomato field and the final trap in located at the University of Guelph, Simcoe research station adjacent to a sentinel plot of unsprayed cucurbit plants.

Current Risk of Cucurbit Downy Mildew

- Symptomatic plants were identified, and downy mildew was confirmed in a commercial cucumber field in Kent County on June 17, 2021. The current level of infection in the field is very low.
- As of June 25th, there have been no positive detections of downy mildew spores in any of the Spornado traps within our network.
- The weather conditions over the past 10 days have been windy and overcast, with substantial rainfall in some regions, providing significant periods of potential infection.
- Due to the presence of CDM in the field, all growers in the region are encouraged to maintain a preventative fungicide program using targeted downy mildew products.
- For the most current Ontario downy mildew control strategy, visit Cucurbit Downy Mildew – get out and scout! – ON-vegetables

Project collaborators: Yaima Arocha Rosete (Sporometrics), Hervé van der Heyden (Phytodata), Rene van Acker & Rachel Riddle & John O'Sullivan (University of Guelph), and Genevieve Marchand (AAFC).