Tuesday, June 11, 2019

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"In This Issue"

OMAFRA Vegetable Crop Specialists

Our numbers are changing, but we aren't going anywhere!
Over the coming weeks, many OMAFRA staff will be getting rid of our office "land line" phones and moving to a single (cell) phone number. Below is a list of the vegetable staff cell phone numbers (and our specialties). If you are uncertain of how to reach someone from OMAFRA, the Agriculture Information Contact Centre (AICC) is also a good place to start 1-877-424-1300 or ag.info.omafra@ontario.ca

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sweet corn, cucumbers, melons, pumpkins, squash, beans, peas, asparagus

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Alliums (onions, garlic, leeks), Brassicas (cabbage, broccoli, cauliflower, brussel sprouts, Asian vegetables), Leafy vegetables

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Managing Bacterial Spot in Ontario Tomatoes: Updated Best Management Practices for Field Production

Updated by: Cheryl Trueman, Ridgetown Campus, University of Guelph; Amanda Tracey, OMAFRA, Ridgetown; Tina Simonton, M.Sc. Candidate, Department of Plant Agriculture, University of Guelph

Original by: Cheryl Trueman, Ridgetown Campus – University of Guelph; Janice LeBoeuf, OMAFRA (former), Ridgetown

Bacterial spot, caused by a group of Xanthomonas bacteria, is an ongoing challenge for field tomato growers in Ontario. For many years, a program of fixed copper sprays was used to manage bacterial spot in plug transplants and field tomatoes. This strategy was mainly to suppress populations early in the season while they are still low and the potential impact on yield and quality is highest. However, given poor performance of this approach in years with favourable conditions, best management practices integrating multiple approaches for management in field production were introduced in 2015. Since 2016, we have worked on validating some of those suggested practices. We also continued evaluations of bactericides for management in field tomatoes. The following is a summary of what we found and an updated table of suggested best management practices for bacterial spot management in field tomatoes.

<u>Efficacy Trials</u>

In trials completed from 2010-2014 at Ridgetown Campus, University of Guelph with a copper sensitive Xanthomonas gardneri isolate, the only consistent spray program year after year was eight applications of Kocide 2000 + Actigard beginning within seven days of transplanting, applied at 7-day intervals (Table 1). This treatment resulted in measurable disease reduction in all years, but it did not always increase yield or reduce spotting on fruit. Other copper-based programs, as well as other tested products, were inconsistent or ineffective in these trials, and in an additional trial completed in 2018. The efficacy data suggests that growers will not see an economic benefit from copper applications for bacterial spot management in field tomatoes.

These results are consistent with those from a survey of the Ontario processing tomato industry we completed in 2014. Over 80% of the growers that responded had used a copper-based spray program in 2014, but only 18% of them thought it had helped to reduce losses to bacterial disease. Furthermore, Dr. Pervaiz Abbasi (AAFC) reports that more than 70% of bacterial spot causing Xanthomonas spp. isolated from tomato in southern Ontario in 2012 were resistant to copper.

Table 1. Efficacy of products for suppression of bacterial spot in Ontario processing tomatoes at Ridgetown Campus, University of Guelph. Tomatoes were inoculated with copper sensitive *Xanthomonas gardneri* (2013-2014, 2018) or *Pseudomonas syringae* pv. *tomato* and *X. gardneri* (2010-2012) two to three weeks after transplanting. **Not all products are registered for use in Canada on tomatoes.**

TABLE LEGEND: E = reduction in early season disease incidence, D = reduction in defoliation, Y = increase in yield, F = reduction in incidence or severity on fruit, '–' = no significant effects, Dark boxes = not tested.

		Reduction vs. Untreated Control [a]						
Treatment [d]	Active Ingredient	2010	2011	2012	2011 + 2012 [b]	2013	2014	2018
Kocide 2000	Copper hydroxide	E	E	-	-	- / - [c]	D	D
Kocide 2000 + Dithane	Copper hydroxide + mancozeb	E	E	-	-	D / D [c]	D, F	
Serenade Max	*Bacillus subtilis* QST 713	E	-	-		-	-	
Kocide 2000 + Serenade Max	Copper hydroxide + *Bacillus subtilis* QST 713	E	E	-			-	
Kocide 2000 alt. Serenade Max	Copper hydroxide alt. *Bacillus subtilis* QST 713	E	E	-				
Regalia Maxx	Extract of *Reynoutria sachalinensis*	-	-	-		-	-	
Kocide 2000 + Regalia Maxx	Copper hydroxide + extract of *Reynoutria sachalinensis*	E	E	-			-	
Kocide 2000 alt. Regalia Maxx	Copper hydroxide alt. extract of *Reynoutria sachalinensis*	E	-	-				
Actigard	Acibenzolar-S-methyl		-	-	-	-	E	
Kocide 2000 + Actigard	Copper hydroxide + acibenzolar-S-methyl		E	E	E, D, Y	E	D, F	
Kocide 2000 alt. Actigard	Copper hydroxide alt. acibenzolar-S-methyl		E	-	-			
Kasumin	Kasugamycin	E						
Kocide 2000 + Kasumin	Copper hydroxide + kasugamycin	E						
Kocide 2000 alt. Kasumin	Copper hydroxide alt. kasugamycin	E						
Bravo	Chlorothalonil					-	-	
Kocide 2000 + Bravo	Copper hydroxide + chlorothalonil					-	F	
Quintec	Quinoxyfen					-		
Kocide 2000 + Quintec	Copper hydroxide					-		
Kocide 2000 + Dithane + Quintec	Copper hydroxide + mancozeb + quinoxyfen					-		
496/A + 497/B	Unknown					-		
496/A + 497/B + Actigard	Unknown + acibenzolar-S-methyl					-		
Taegro	*Bacillus subtilis* var. *amyloliquefaciens* FZB24					-		
Agral 90	Non-ionic surfactant					-		
Surround	Kaolin clay						-	
Double Strength Trace Elements	Water soluble copper		-					
THIS Copper & Sulfur	Elemental copper + sulphur		-					
Cal-Mag-B alt. KP350DP	Ca, Mg, B alt. extract from *Saccharomyces cerevisiae*, chelated micronutrients, alpha-keto acids, and humic acid			-				
Cal-Mag-B alt. KP350OR	Ca, Mg, B alt. extract from *Saccharomyces cerevisiae*, chelated micronutrients, alpha-keto acids, and humic acid			-				
Cal-Mag-B alt. KP1000DP	Ca, Mg, B alt. chelated micronutrients, alpha-keto acids, and humic acid			-				
LifeGard	*Bacillus mycoides* isolate J							-
Double Nickel LC	*Bacillus amyloliquefaciens* strain D747							-
Phostrol	Mono- and dibasic sodium, potassium, and ammonium phosphites							-
Double Nickel + Phostrol	*Bacillus amyloliquefaciens* strain D747 + Mono- and dibasic sodium, potassium, and ammonium phosphites							-

[a] Letters indicate significant differences from the untreated control in each year ($P \leq 0.05$, Duncan's new MRT or Tukey's HSD). [b] Results from a trial that was repeated in 2011 and 2012. Data from both years was pooled together because analysis indicated no significant trt*trial interaction. [c] Included in two trials in 2013. [d] All programs, except the Cal-Mag-B/KP and Phostrol programs, were applied eight times on a 7-day interval, with the first application no more than seven days after transplanting 2010-2014 and 14 days in 2018. The Cal-Mag-B/KP programs consisted of a total of 11 applications. The Phostrol alone program consisted of one drench application just before transplanting in addition to eight foliar applications. Trials from 2010 to 2013 were completed using tomato cv. H9909 and the trials in 2014 and 2018 using cv. H5108.

New Strategy?

If we hope to improve management of bacterial spot, we have to move beyond a spray program that has little or no effect on reducing losses in yield and quality. In 2016, we suggested a new focus on best management practices to exclude the pathogen from tomato cropping systems and reduce its spread using biosecurity and sanitation practices common in the greenhouse industry. The overarching strategy is to adopt multiple practices to limit spread and delay an epidemic of bacterial spot as much as possible. We evaluated the potential transmission of X. gardneri during transplant shipping and transplanting and assessed the efficacy of disinfectants on trailer and transplanter surfaces.

Transmission during transplant shipping

Using a mock trailer setup, the appearance of symptoms after irrigating a) top to bottom, b) bottom to top, and c) using a tray dip, was evaluated. A tray with symptomatic seedlings on the top shelf of each mock trailer served as a source of inoculum. X. gardneri moved downward from symptomatic seedlings to healthy seedlings in a simulated plug trailer setup after irrigation (Table 2). Disease incidence on seedlings irrigated with a spray nozzle inside the trailer was higher than a tray dip outside the trailer, but transmission still occurred with a tray dip (Table 3). The results show that X. gardneri can spread easily within plug trailers when seedlings are irrigated.

Table 2. Effect of tray distance on bacterial spot symptom appearance in tomato seedlings irrigated in a simulated plug trailer and incubated for 14 days, Ridgetown Campus Greenhouse.

Shelf distance below inoculum source (cm)	Incidence (% seedlings)
30.5	0.8 a[a]
61.0	0.4 ab
91.5	0.1 c
122.0	0.2 bc

[a] Mean of four trials. Numbers in a column followed by the same letter are not significantly different, $P \le 0.05$, Tukey's HSD.

Table 3. Effect of irrigation on bacterial spot symptom appearance in tomato seedlings irrigated in simulated plug trailer and incubated for 14 days, Ridgetown Campus Greenhouse.

Irrigation method	Incidence (% seedlings)
Healthy control, irrigated bottom to top	0.0 c[a]
Top Symptomatic, irrigate bottom to top	5.4 a
Top Symptomatic, irrigated top to bottom	3.9 a
Top Symptomatic, dip irrigation	0.4 b

[a] Mean of four trials. Numbers in a column followed by the same letter are not significantly different, $P \le 0.05$, Tukey's HSD.

Transmission during transplanting

Indoors: X. gardneri was present on previously healthy tomato seedlings that passed through the transplanter after seedlings with bacterial spot symptoms (Table 4), showing contaminated transplanting equipment is a pathway for spread.

Table 4. *X. gardneri* population recovered from tomato leaf surfaces after contact with contaminated transplanting equipment.

First 6 seedlings	Next 46 seedlings	Leaf moisture	*X. gardneri* population (CFU/g leaf tissue)	
			Trial 1	Trial 2
Healthy	Healthy	Wet	0 a	0 a
Symptoms	Healthy	Dry	1405 a	1 a
Symptoms	Healthy	Wet	2086 a	5 a

[a] Numbers in a column followed by the same letter are not significantly different, $P \le 0.05$, Tukey's HSD.

Outdoors: Transplants with bacterial spot symptoms were passed through a transplanter before healthy seedlings and bacterial symptom appearance was monitored. Symptoms usually appeared at the same time whether symptomatic seedlings were planted using a transplanter or manually after transplanting (Figure 1). This means that even though X. gardneri can be transmitted on transplanting equipment, weather conditions play a key role in dissemination and symptom appearance (otherwise, the pattern of appearance among the two inoculated treatments would be different). Strict measures to clean and sanitize equipment and worker hands during transplanting may not be worth it, but there could still be value in implementing these measures when moving between fields, once or twice a day in the same field, and when switching varieties or transplant supplier within a field.

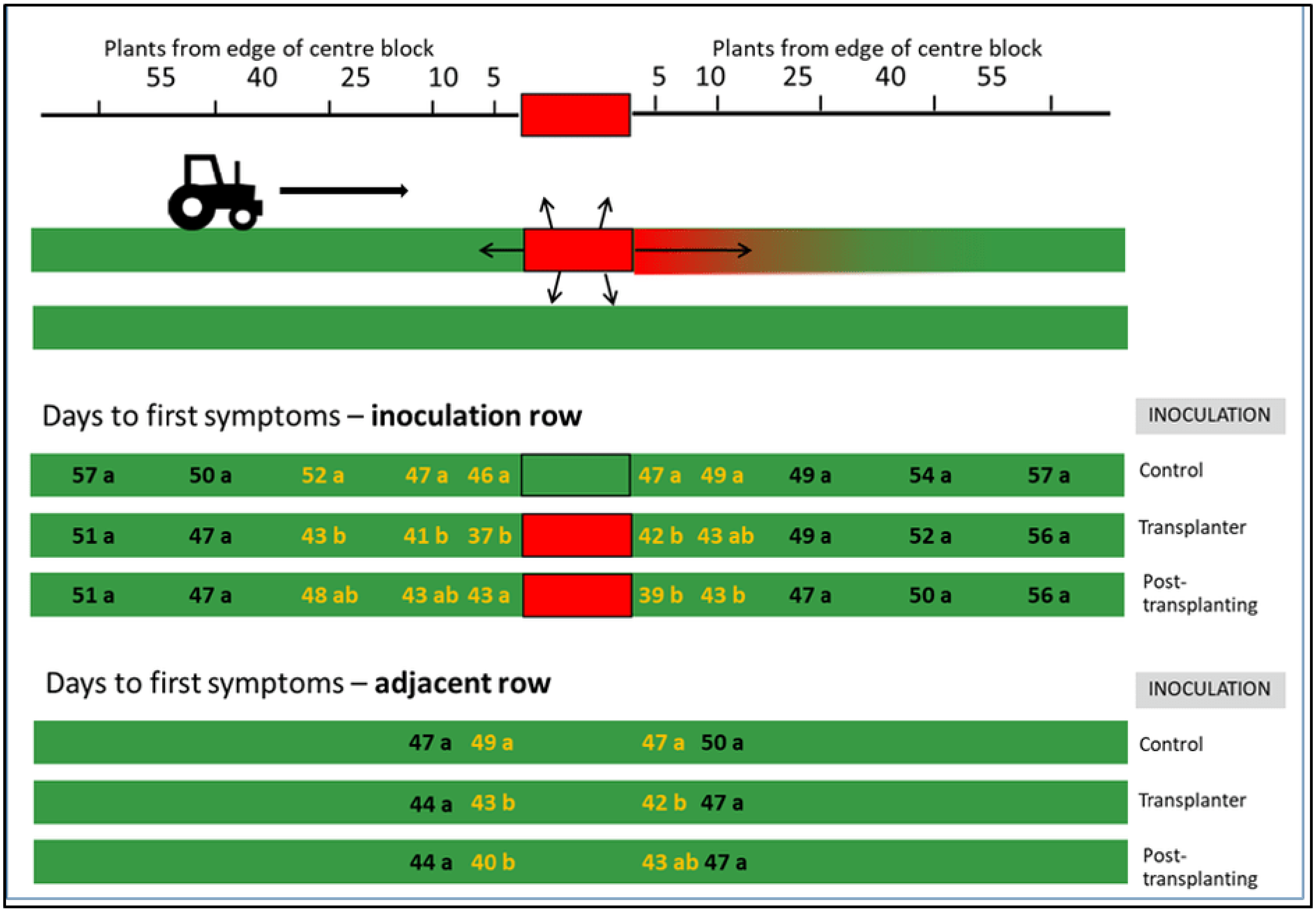


Figure 1. Number of days until the first appearance of bacterial spot symptoms in processing tomatoes, Ridgetown, 2016-2018. Numbers in a column followed by the same letter are not significantly different, P ≤ 0.05, Tukey's HSD.

<u>Disinfecting Equipment and Structures</u>

There are four major types of disinfectants: bleach, quaternary ammonium compounds (i.e. KleenGrow and Chemprocide), peroxygen compounds (i.e. hydrogen peroxide and Virkon) and alkalis (i.e. C-Clean and TSP). It is important to consider the material you are disinfecting when choosing a product.

To properly clean and disinfect there are six important steps:

1. Remove excess organic matter by brushing, spraying and/or rinsing.
2. 2. Use a pre-disinfection washing agent or detergent and apply at a low pressure (50-100psi).
3. 3. Repeat step one for particularly difficult surfaces (i.e. rubber and plastic) or surfaces that may have a high level of inoculum.
4. 4. Rinse well with water to remove any detergent residues and organic matter that may interfere with the disinfectant.
5. 5. Allow the surface to dry completely.
6. 6. Apply the disinfectant at label rates and allow it to remain wet on the surface for 15-30 minutes.

Always read product labels and directions thoroughly to ensure the best product efficacy and user safety.

Managing Bacterial Spot in Ontario Tomatoes: Updated Best Management Practices for Field Production…con't

To evaluate the efficacy of common disinfectants to clean transplant trailer and transplanter surfaces, we completed two trials using Grade 319 caste aluminum and tarp (18 oz vinyl). Materials were dipped in a solution of X. gardneri, allowed to dry overnight, washed in soapy water (0.1% v/v Dawn dish soap), rinsed in tap water, dipped in the treatment solution for 2 minutes, allowed to sit for 10 min (bleach for 30 min), rinsed in tap water, and then air dried. Contact plates were applied to the surfaces, incubated for three days and the total bacterial count determined (Table 5). Overall, the most consistent treatment was washing with soap and water in combination with Hyperox, but Oxidate 2.0, Virkon Greenhouse, and Clorox were also effective in most trials. Kleengrow was not effective on tarp material and effective in only one of two trials on aluminum using this method.

Table 5. Total bacterial counts recovered from contact plates exposed to aluminum and tarp samples inoculated with *X. gardneri*.

Treatment (concentration)	Soap and water [a]	Inoculated [b]	Total bacterial count per plate (cfu/25 cm^2)			
			Aluminum		Tarp	
			Trial 1	Trial 2 [c]	Trial 1 [c]	Trial 2
None	No	No	64 a [d]	70 a	61 a	74 a
None	Yes	No	54 a	61 a	31 ab	51 ab
None	No	Yes	54 a	62 a	65 a	66 a
None	Yes	Yes	45 ab	35 ab	38 ab	57 ab
Clorox (10%)	Yes	Yes	37 abc	**16 b**	**15 bcd**	**30 b**
Kleengrow (0.8%)	Yes	Yes	39 abc	**24 b**	26 abc	46 ab
Virkon Greenhouse (1%)	Yes	Yes	**17 bc**	**22 b**	**8 cd**	42 ab
Oxidate 2.0 (1%)	Yes	Yes	**19 bc**	**17 b**	**8 cd**	42 ab
Hyperox (0.8%)	Yes	Yes	**9 c**	**19 b**	**8 d**	**27 b**

[a] Completed after inoculation and before treatment. [b] Inoculated the day before treatment with 1 x 10^7 cfu/mL *X. gardneri* DC00T7A. [c] Data was transformed using a log transformation and the back-transformed means are presented. [d] Numbers in a column followed by the same letter are not significantly different at $P \leq 0.05$, Tukey's HSD.

Updated Best Management Practices for Bacterial Spot Management in Tomato

Emphasizing tactics that exclude the pathogen from tomato cropping systems and reduce spread within the crop is not a simple strategy, and there are costs involved, but keep in mind the cost of spray programs that have demonstrated little benefit in reducing bacterial spot severity. The strategies presented below may help reduce the impact of bacterial spot on field tomatoes in Ontario and are ranked by the level of expected impact.

Tier 1 - likely to have the biggest impact	
Shipping/ Picking Up Transplants	**One crop per load.** ➢ Do not arrive to pick up transplants with a trailer already ½ loaded with host plants (tomatoes, pepper) from another greenhouse.
	Clean and sanitize plant trailer between loads. ➢ Use appropriate sanitation chemicals & concentrations.
	Avoid irrigating transplants ➢ If irrigation is required, remove plants, dip trays in water and avoid irrigation water contact with leaves and stems.
Transplanting	**Clean and sanitize the transplanter (surfaces that contact plants and trays) between fields, once or twice a day in the same field, and when switching varieties or transplant supplier within a field.** ➢ Use appropriate sanitation chemicals & concentrations.
	Transplanting crew cleans and sanitizes their hands between fields, once or twice a day in the same field, and when switching varieties or transplant supplier within a field. ➢ Consider this: at a transplanting rate of 1.5 ac/hour with 6 workers (1/row) and 13,000 plugs per acre, 3,250 plugs are touched per person per hour.
Tier 2 - some impact expected	
In-season	**Avoid planting tomatoes immediately adjacent to other host crops (peppers, other tomatoes).**
	Clean and sanitize sprayer / cultivator equipment between fields. ➢ Bacteria can be spread from field to field on equipment that comes into contact with the crop.
	In processing and unstaked fresh market tomatoes, eliminate hoeing beyond 3 or 4 weeks after transplanting. ➢ This will reduce leaf tearing once the rows start to fill in.
	Eliminate inter-row cultivating beyond 3 or 4 weeks after transplanting. ➢ This will reduce leaf tearing once the rows start to fill in.
	When working with staked plants (pruning, tying), clean and sanitize tools between each plant. Change gloves or clean and sanitize hands every row. ➢ Bacteria can be spread from plant to plant on tools and workers' hands.
	Crop scouts and other visitors instructed to clean and sanitize hands or wear gloves prior to entering each field. Wearing plastic booties which are changed after each field will also limit the spread of soilborne pathogens from field to field.

Tier 3 - little impact expected compared to tiers 1 or 2	
In-season	**Controlling weeds in the field.** ➢ Weeds are potential hosts for bacterial spot and interfere with air movement and drying of the crop canopy.
	Fallowing weak areas within the field (historic poor drainage, low areas). ➢ This may be where the severe symptoms show up first but is probably not the initial source of the inoculum.
Tier 4 – no impact expected on bacterial spot	
Pre-season	**Crop rotation.** ➢ This is beneficial for management of several pests but is not as useful for managing bacterial spot.
In-season	**Applying other protective spray programs (fungicides).** ➢ Years of bacterial spot efficacy research at Ridgetown Campus has shown minimal to no beneficial impact to any of the spray programs tested, except copper + Actigard. However, Actigard is no longer sold in Canada.
	DSV-based spraying of bactericides. ➢ TomCAST is designed based on the biology of the fungal pathogens that cause early blight, septoria leaf spot, and anthracnose. DSV-based spray timing is not appropriate for bacterial spot management.
	Using disinfectant on tools, equipment, hands, and other surfaces without pre-cleaning to remove films and organic matter. ➢ Disinfectants must be applied to clean surfaces to be effective.
	Beginning a program of cleaning and disinfecting tools, equipment, hands, and other surfaces after disease is already established. ➢ Bacteria are present (and can be spread) long before the first symptoms are visible.

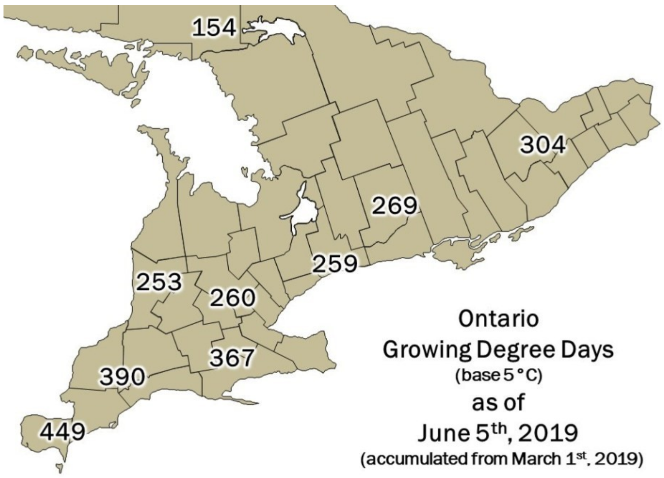
Additional resources

Good Agricultural Practices: Cleaning and Sanitizing (http://www.omafra.gov.on.ca/english/food/foodsafety/producers/gap-gf-cs-cleaning.htm)
Sanitation Guidelines for Management of Pest and Disease of Greenhouse Vegetables (http://www.omafra.gov.on.ca/english/crops/facts/14-033.htm)
Biosecurity is Important in Horticulture Crops too (Nova Scotia)(https://www.perennia.ca/wp-content/uploads/2018/04/biosecurity-is-important-in-horticulture-crops-too.pdf)

Acknowledgements: This research was supported by the Ontario Agri-Food Innovation Alliance and the Ontario Tomato Research Institute.

VCR – Vegetable Crop Report – June 6, 2019

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 – The cool wet spring has continued to affect temperature and degree day accumulation in almost all of the growing regions of Ontario. Almost all counties range from being marginally behind, to significantly behind their respective growing degree day averages of the previous 10 years with exception to Huron. Cooler temperatures have continued to keep degree days in Sudbury at about half of its ten year average. While some regions are now receiving near average temperatures, the lack of sun, and late planting dates has slowed the growth and development of many crops in most planted areas.

Rainfall – A wet rainy may pushed many regions above their 10 year average rainfall for May, including Kemptville, Peterborough, Simcoe, Sudbury, and Wellington. Chatham, Essex, Durham, Huron, and Norfolk counties were close to, but did not exceed their ten year averages for rainfall in May. Consistent rainfall every few days combined with a lack of drying conditions (no sun/minimal wind) has still kept fields saturated, further delaying seeding and direct transplanting in many areas. The rainy spring has especially continued in Essex with almost half of its monthly rainfall average being met within the first five days of the month alone – all other regions are well below the June ten year averages as would be expected at this point in the month. Fields are slowly being planted and/or just beginning in many regions however many fields are still too saturated to allow entry.

Crop Updates

Brassica Crops – Fresh market cabbage, early broccoli and cauliflower transplants are still being planted in several counties. Keep an eye out for flea beetles and diamondback moths as they are now active. The degree day threshold for cabbage maggot emergence has been reached in Essex and Chatham-Kent.

Carrots – The bulk of carrots are now in the ground with early seeded fields growing well. Carrot weevils are now active and being caught in carrot bait traps. Monitor for adults with carrot bait traps to determine if the field has reached the treatment threshold of 1.5 weevils/trap.

Celery – In general insect pressure is low. While walking the field, be on the look out for quick-moving tarnished plant bugs. The degree day threshold for aster leafhoppers and tarnished plant bugs has been reached in Essex, Chatham-Kent, Norfolk and Kemptville.

Garlic – Plants in wet spots in fields have been showing leaf dieback of the oldest (lowest) leaves. Scapes have started to emerge in Essex county. Trap counts for leek moth have been low but are building in some areas. Dig up wilted plants and inspect the basal plate, then open the bulb and look for seedcorn maggot larvae as they have been identified to be the cause of wilting in a few fields. Be sure to check out the Garlic Growers Association of Ontario's annual field day this Saturday, June 8th at 43954 Spencetown Road, Wroxeter, Ontario. Registration is at 9:30 and presentations will start at 10. Be sure to register at https://www.garlicgrowersofontario.com/events-1/ggao-2019-field-day to ensure that they have enough food for lunch.

Onions – Most acres of direct seeded onions have been planted across the province with the earliest seeded onions at the 2nd to 3rd leaf stage however most fields are averaging around the 1st leaf stage. The first generation of onion and seedcorn maggot flies are active in most areas except for Sudbury and further North. Dig up wilted/stunted plants and scout for maggots or feeding damage.

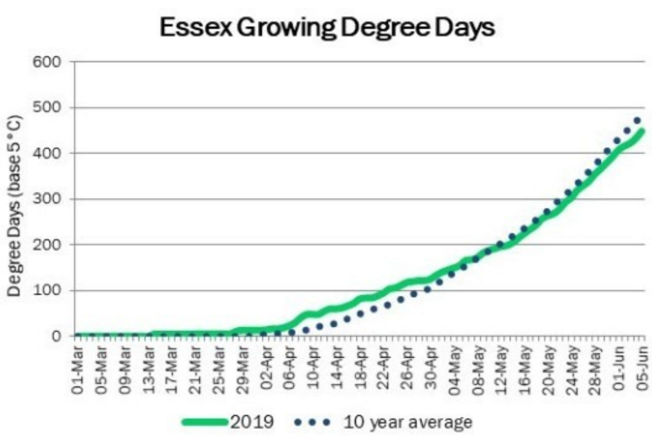
Peppers – Planting began last week and is about 1 week behind schedule.

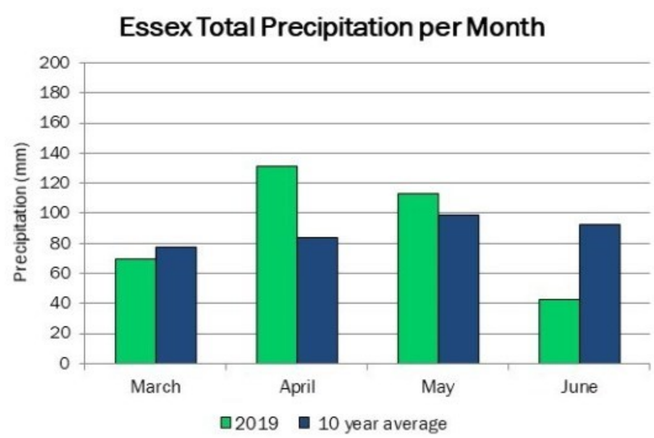
Potatoes – Overwintering Colorado potato beetle adults are starting to emerge, mate and lay eggs. In order to monitor whether the CPB are becoming resistant to our registered insecticides, AAFC will be conducting a CPB resistance survey again this season. If you see any CPB populations in your potatoes, please contact Dennis (519-766-5337) and we can come and take a sample to be tested.

Tomatoes -Planting is about 3-4 weeks behind and only about 80-85% of transplants are in the ground. Wet weather conditions are also ideal for wireworm and black cutworm. There has been more damage observed on transplants this year when compared to previous seasons, especially on sandier soils.

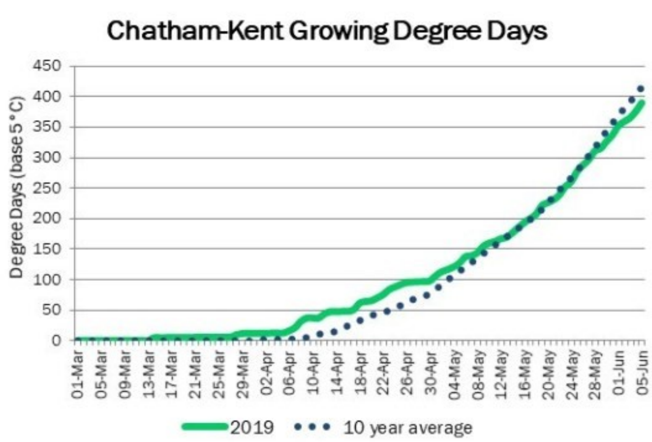
Pest Degree Day Forecasting
Select a region below for the latest weather, crop and pest degree day information:
Essex County(https://onvegetables.com/2019/06/06/vcr-4/#essex)
Chatham-Kent County(https://onvegetables.com/2019/06/06/vcr-4/#chatham-kent)
Norfolk County(https://onvegetables.com/2019/06/06/vcr-4/#norfolk)
Huron County(https://onvegetables.com/2019/06/06/vcr-4/#huron)
Wellington County(https://onvegetables.com/2019/06/06/vcr-4/#wellington)
Simcoe County(https://onvegetables.com/2019/06/06/vcr-4/#simcoe)
Durham County(https://onvegetables.com/2019/06/06/vcr-4/#durham)
Peterborough(https://onvegetables.com/2019/06/06/vcr-4/#peterborough)
Kemptville(https://onvegetables.com/2019/06/06/vcr-4/#kemptville)
Sudbury(https://onvegetables.com/2019/06/06/vcr-4/#sudbury)

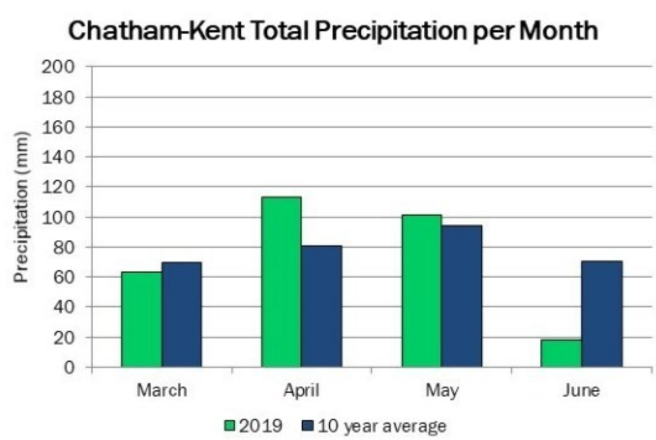
Essex County



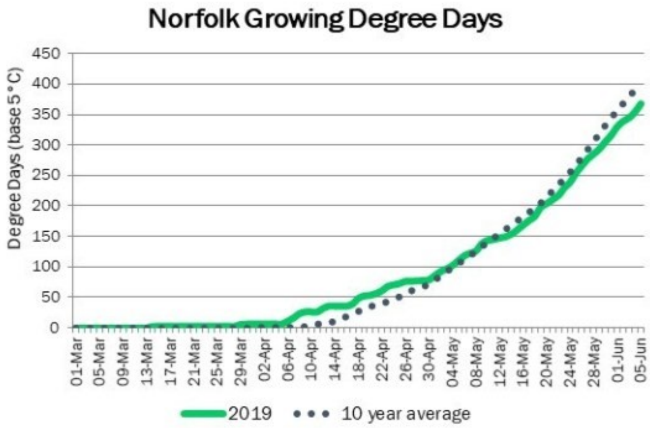


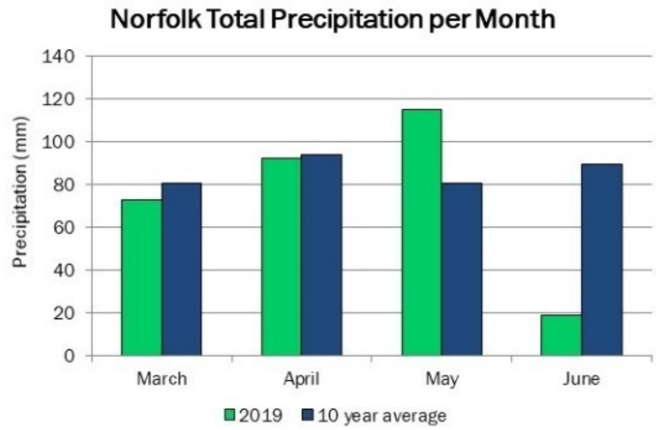
Chatham-Kent County



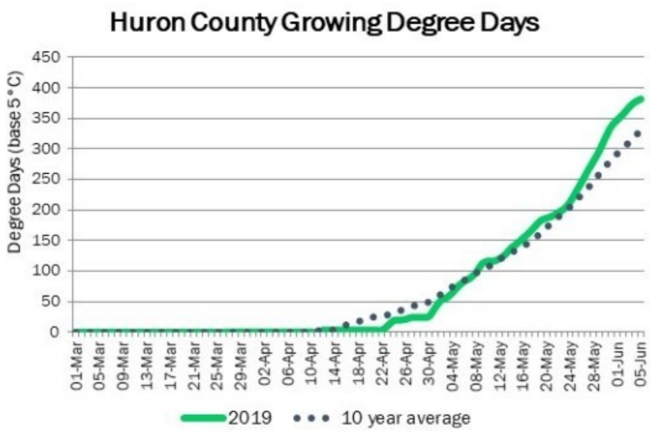


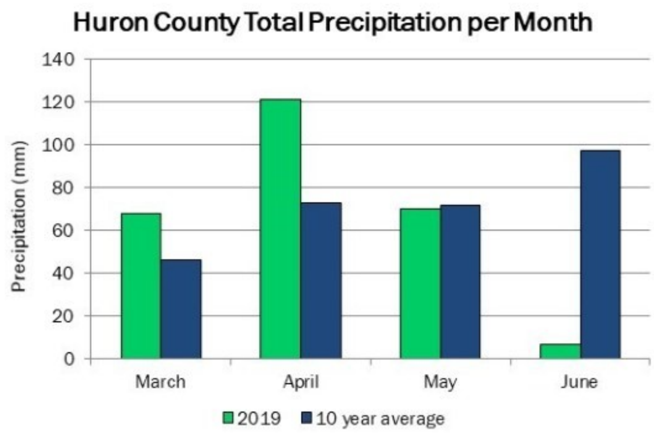
Norfolk County



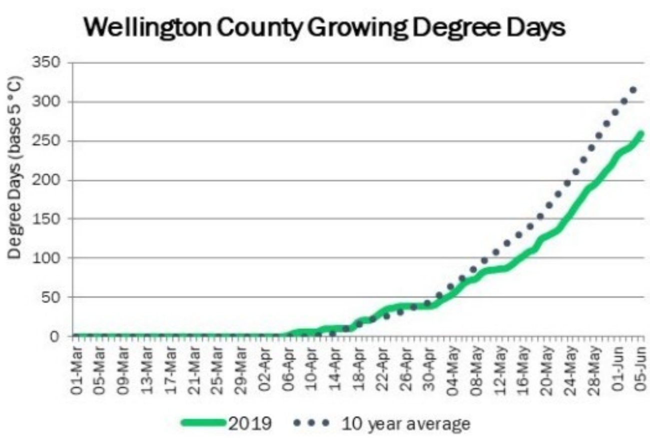


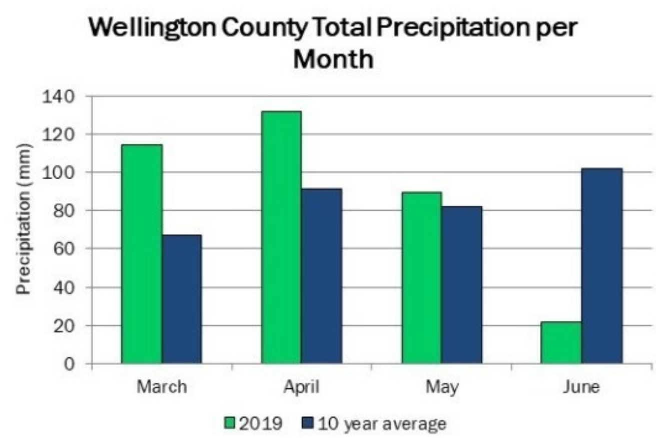
Huron County



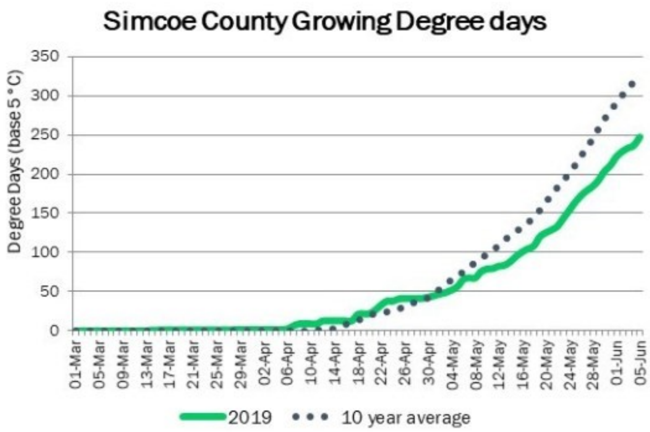


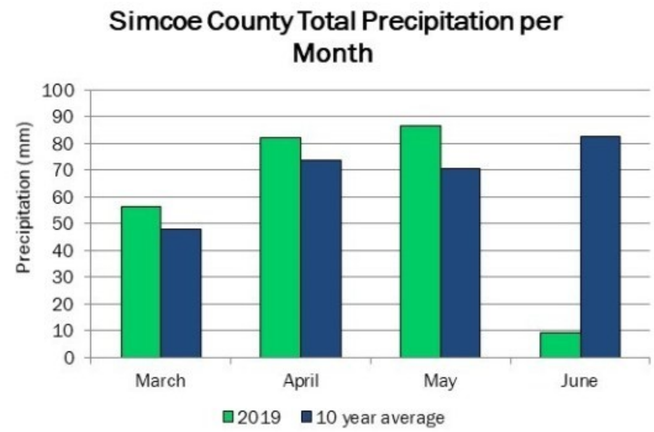
Wellington County



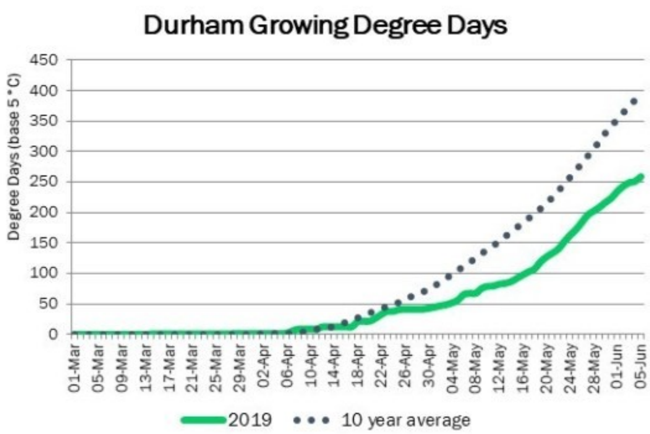


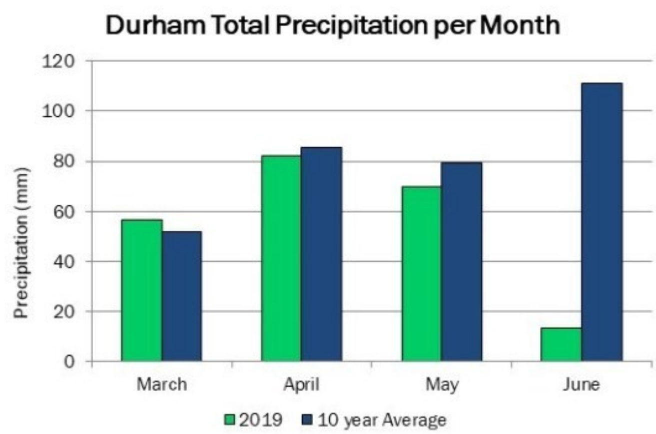
Simcoe County



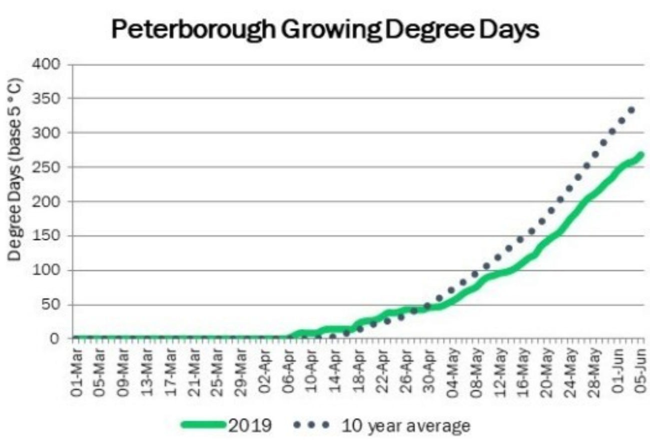


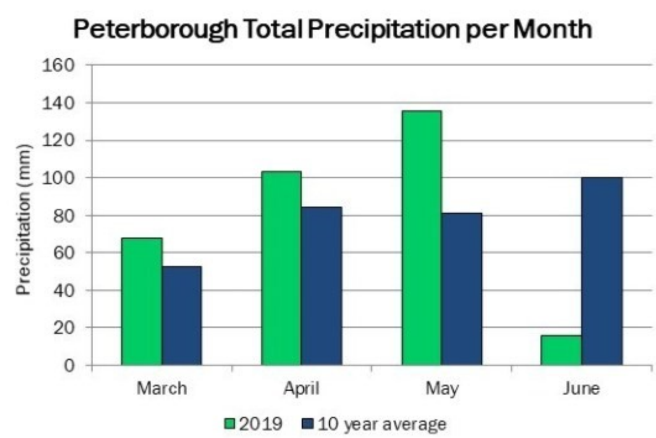
Durham County



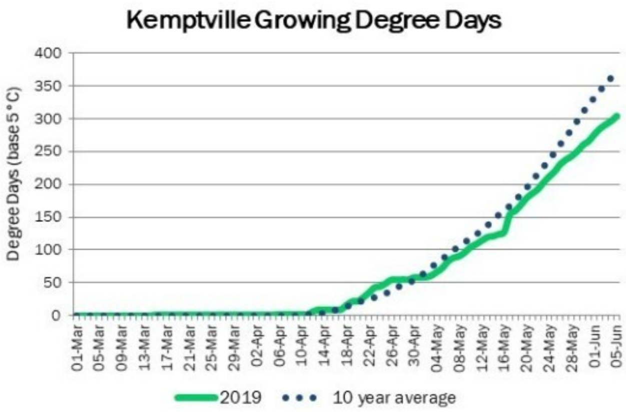


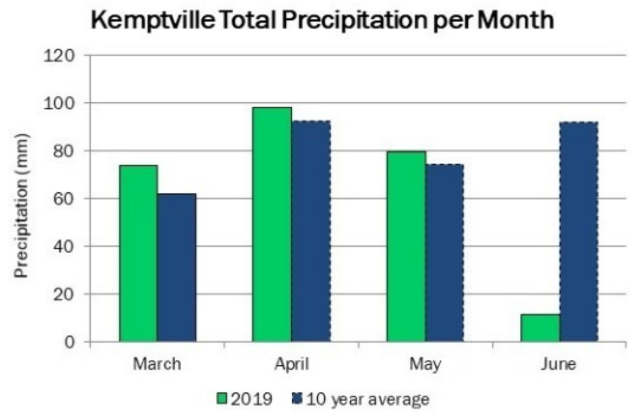
Peterborough



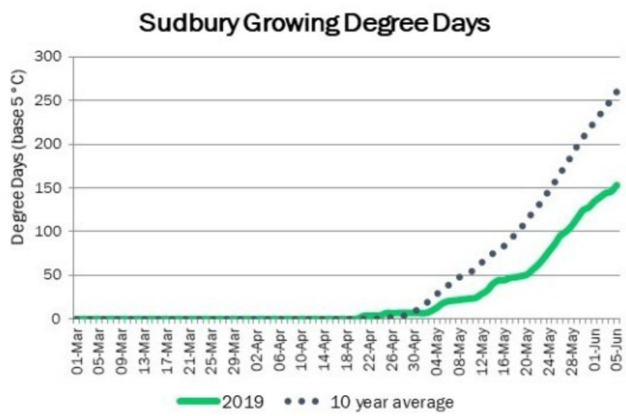


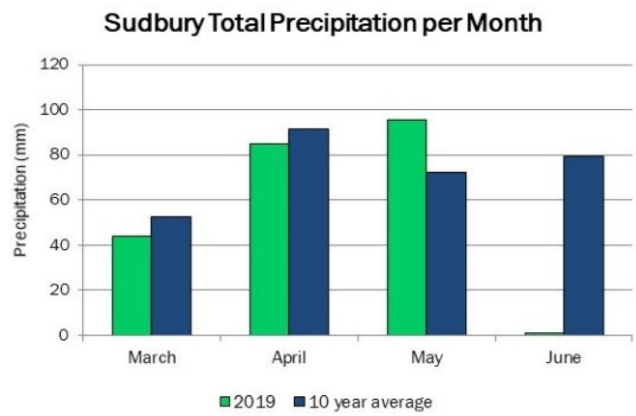
Kemptville





Sudbury





Pest	Carrot Rust Fly	Onion Maggot	Carrot Weevil	Aster Leafhopper	Tarnished Plant Bug	Cabbage Maggot	Seedcorn Maggot
THRESHOLD	**329-395**	**210-700**	**138-156**	**128**	**40**	**314**	**200**
Essex	592	**519**	327	**225**	**112**	**387**	**519**
Chatham-Kent	527	**455**	276	**179**	**76**	**331**	**455**
Norfolk	495	**428**	257	**166**	**63**	310	**428**
Huron	**366**	**307**	163	90	22	204	**307**
Wellington	**370**	**314**	169	98	32	211	**314**
Simcoe County	**358**	**301**	158	91	28	200	**301**
Durham	**370**	**312**	170	104	32	211	**313**
Peterborough	**381**	**322**	176	100	27	220	**320**
Kemptville	417	**358**	211	**132**	**43**	256	**358**
Sudbury	237	193	91	46	7	119	193

Thresholds
Use these thresholds as a guide, always confirm insect activity with actual field scouting and trap counts.