

ONvegetables



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Agriculture Youth Green Jobs Initiative

Agriculture and Agri-Food Canada has announced funding under the Agriculture Youth Green Jobs Initiative (<http://www.agr.gc.ca/eng/programs-and-services/list-of-programs-and-services/agricultural-youth-green-jobs-initiative/?id=1459879253586>).

The Agricultural Youth Green Jobs Initiative (<http://www.agr.gc.ca/eng/programs-and-services/list-of-programs-and-services/agricultural-youth-green-jobs-initiative/?id=1459879253586>) will help fund internships for post-secondary graduates working in the agriculture industry. These internships would include activities or projects that benefit the environment. Please note that this is not a summer employment program.

Funding is available through the following two streams:

1. Green Farms Stream (<http://www.agr.gc.ca/eng/programs-and-services/list-of-programs-and-services/agricultural-youth-green-jobs-initiative/green-farms-stream/?id=1459879871410>): Farm operators could receive up to a maximum of \$10,000 per intern to implement projects that are environmentally beneficial.
2. Green Internships Stream (<http://www.agr.gc.ca/eng/programs-and-services/list-of-programs-and-services/agricultural-youth-green-jobs-initiative/green-internships-stream/?id=1459887524516>): Employers in the agricultural sector but not directly on farm could receive up to a maximum of \$16,000 per intern to undertake environmental activities, services or research that will benefit the agriculture sector.

“In This Issue”

- ◆ Agriculture Youth Green Jobs Initiative
- ◆ Farmland agreements
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Farmland agreements

Are you looking for ways to bring more sustainability into your farmland lease agreements? Whether you're a renter or a landlord, the resources at <http://farmlandagreements.ca/> can help. The site was developed by Farm & Food Care Ontario (<http://www.farmfoodcareon.org/>) and Ontario Farmland Trust (<https://ontariofarmlandtrust.ca/>), with funding from the Great Lakes Agricultural Stewardship Initiative (<http://www.ontariosoilcrop.org/oscia-programs/glasi/>).

IMPROVING ONTARIO'S FARMLAND THROUGH WRITTEN AGREEMENTS

FARMLAND LEASES & LONG-TERM EASEMENTS

farmlandagreements.ca

Managing Bacterial Spot in Ontario Field Tomato Production

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Janice LeBoeuf, Vegetable Crop Specialist, OMAFRA, 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. Knowing that copper and other products are relatively weak on bacterial disease, the strategy was to suppress populations early in the season while they are still low. Once symptoms are present, the bacterial populations are so high that we would not expect to have a significant impact on disease development with a spray program.

Efficacy Trials

In recent years there have been several new products registered that include bacterial spot on their label, and many more efficacy trials to evaluate the field performance of these treatments. In trials completed from 2010-2014 (<https://onvegetables.com/2015/03/26/managing-bacterial-spot-in-ontario-field-tomato-production-time-to-hit-the-refresh-button/#efficacy-table>) at Ridgetown Campus,

University of Guelph, with a copper sensitive *Xanthomonas gardneri* isolate, the only consistent spray program year after year was 8 applications of Kocide 2000 + Actigard beginning within 7 days of transplanting, applied at 7-day intervals. This treatment resulted in measurable disease reductions in all years, although it did not always increase yield or reduce spotting on fruit (Syngenta has discontinued selling Actigard in Canada, but as of the date of this post, there are still supplies of the product available from many ag outlets in southern Ontario).

Other copper-based programs, as well as other tested products, were inconsistent or ineffective. The efficacy data suggests that growers will not see an economic benefit from copper applications for bacterial spot management in field tomatoes. The efficacy of copper and other treatments on tomato transplants continues to be evaluated at Ridgetown Campus.

These results are consistent with those from a survey of the Ontario processing tomato industry 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 (Agriculture and AgriFood Canada) reports that more than 70% of bacterial spot causing *Xanthomonas* spp. isolated from tomato in southern Ontario in 2012 were resistant to copper.

New Strategy

What is clear is that 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. We suggest a new focus on tactics to exclude the pathogen from tomato cropping systems and reduce its spread. The overarching strategy is to adopt multiple practices to limit spread and delay an epidemic of bacterial spot as much as possible. We have developed a list of best management practices for field tomato growers in Ontario. **Over the next three years, research will be completed at the Ridgetown Campus to validate many of these practices with funding from the Ontario Tomato Research Institute and the OMAFRA/University of Guelph Partnership program.**

Managing Bacterial Spot in Ontario Field Tomato Production...con't

Tier 1 – likely to have the biggest impact	
Shipping/ Picking Up Transplants	<p>One crop per load.</p> <ul style="list-style-type: none"> Do not arrive to pick up transplants with a trailer already containing host plants (tomatoes, pepper) from another greenhouse.
	<p>Clean and sanitize plant trailer between loads.</p> <p>Use appropriate sanitation chemicals & concentrations (see Additional Resources).</p>
Holding Transplants	<p>Plants need ventilation.</p> <ul style="list-style-type: none"> If holding plants overnight or for an extended period of time, provide adequate ventilation to the plant trailer, to avoid a build-up of humidity and condensation in the trailer, which would promote the growth of bacterial diseases.
Transplant- ing	<p>Design plug watering system to minimize dripping or splashing onto other trays of plants.</p> <ul style="list-style-type: none"> Bacterial pathogens can move in water.
	<p>Clean and sanitize the transplanter (surfaces that contact plants and trays) between field and varieties.</p> <ul style="list-style-type: none"> Use appropriate sanitation chemicals and concentrations.
	<p>Transplanting crew cleans and sanitizes their hands or changes to new disposable gloves at every break.</p> <ul style="list-style-type: none"> Bacteria can be spread from plant to plant on workers' hands. Consider this: on a 6-row transplanter, covering 1.5 ac/hour with 13,000 plugs per acre, each worker touches 3,250 plugs per hour.
In-season	<p>Manage irrigation to minimize wounding and duration of leaf wetness.</p> <ul style="list-style-type: none"> If overhead irrigating, use low pressure systems (boom, not gun) to minimize wounding and splashing. If irrigating, aim to minimize the duration that leaves are wet (timing, air movement, weed control).
Tier 2 – some impact expected	
Pre-season	<p>Consider adding windbreaks to slow wind and wind-blown rain.</p> <ul style="list-style-type: none"> Strong winds can open microscopic wounds on the tomato foliage — an entry point for bacterial pathogens. Bacterial pathogens can be transferred from plant to plant in wind-blown mists and droplets.
In-season	<p>Avoid planting tomatoes immediately adjacent to other host crops (peppers, other tomatoes).</p>
	<p>Clean and sanitize sprayer / cultivator equipment between fields.</p> <ul style="list-style-type: none"> Bacteria can be spread from field to field on equipment that comes into contact with the crop.
	<p>In processing and unstaked fresh market tomatoes, eliminate hoeing beyond 3 or 4 weeks after transplanting.</p> <ul style="list-style-type: none"> This will reduce leaf tearing once the rows start to fill in.
	<p>Eliminate inter-row cultivating beyond 3 or 4 weeks after transplanting.</p> <ul style="list-style-type: none"> This will reduce leaf tearing once the rows start to fill in.
	<p>When working with staked plants (pruning, tying), clean and sanitize tools between each plant. Change gloves or clean and sanitize hands every row.</p> <ul style="list-style-type: none"> Bacteria can be spread from plant to plant on tools and workers' hands.
	<p>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.</p>
	<p>Use 8 applications of copper + Actigard, applied on a 7-day interval, starting within 7 days of transplanting.</p> <ul style="list-style-type: none"> Five years of research trials at Ridgetown Campus have shown that this is the most consistent program for reducing early season disease and in some cases, reducing defoliation. It is the only program that has shown a yield benefit (in 1 year out of 5) in the research trials. In the absence of Actigard, no program exists which has shown effectiveness in Ridgetown research trials with 8 applications on 7-day intervals. <p>Note: Syngenta Canada reports that supplies of Actigard are still available at many ag outlets in southern Ontario as of the date of this post.</p>

Managing Bacterial Spot in Ontario Field Tomato Production...con't

Tier 3 – little impact expected compared to tiers 1 or 2	
In-season	Controlling weeds in the field. <ul style="list-style-type: none"> •Weeds are potential hosts for bacterial spot and interfere with air movement and drying of the crop canopy.
	Following weak areas within the field (historic poor drainage, low areas). <ul style="list-style-type: none"> •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. <ul style="list-style-type: none"> •Although beneficial for managing many crop pests, it is not as useful for managing bacterial spot.
In-season	Applying other protective spray programs, except the program listed in Tier 2. <ul style="list-style-type: none"> •Five years of bacterial spot efficacy research at Ridgetown Campus has shown minimal to no benefit to any of the spray programs tested, except 8 applications of copper + Actigard as described in Tier 2.
	DSV-based spraying of bactericides. <ul style="list-style-type: none"> •TomCAST is 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. <ul style="list-style-type: none"> •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. <ul style="list-style-type: none"> •Bacteria are present (and can be spread) long before the first symptoms are visible.

Do More Than Think About It

When adopting a new bacterial disease management program on-farm, it is critical to have it written down, to train the people who will be doing the work, and to keep records. Written protocols and/or checklists don't have to be elaborate, but are needed to ensure activities are not forgotten. Review them often as a team; update them and make changes based on experience and new information.

In conclusion, the research shows that it is time to move beyond the spraying strategy and put the focus on other management practices. The emphasis must be on **tactics to exclude the pathogen from tomato cropping systems and reduce its spread within the crop**. This will require adoption of multiple practices to limit spread and delay an epidemic of bacterial spot as much as possible. This is not a simple strategy, and there are costs involved, but keep in mind the cost of spray programs that have marginal, if any, benefit and the cost in potential losses to bacterial spot.



Additional resources

On-Farm and Greenhouse Sanitation and Disinfection Practices to Minimize the Impact of Plant Pests (BC Ministry of Agriculture) (<http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/animal-and-crops/plant-health/on-farm-and-greenhouse-sanitation-and-disinfection-practices-to-minimize-the-impact-of-plant-pests.pdf>)

Forecasting Frost Events – Comparison of Weather Forecast Sites

Sean Westerveld , Ginseng & Medicinal Herbs Specialist, OMAFRA, Simcoe

Frost events have been increasing in recent years and growers of a wide range of crops have been implementing different frost mitigation measures to protect their crops. For some frost mitigation strategies, reliable forecasts beyond the same day are not as necessary, since they can be implemented on a moment's notice (e.g. wind machines and irrigation). For other strategies such as row covers or deciding when to transplant tender annuals, it is important to have a reliable forecast a few days in advance. For example, for ginseng, it can take up to two days to put row cover over the crop.

As a result, we compared 5 forecasting sites over a month from early April to early May to see how accurate they were for the Simcoe (Norfolk County) area. Forecasts were determined for Simcoe, and the forecasts were compared to a weather station at the Simcoe Research Station approximately 2 km from Simcoe. It should be noted that this was not a scientific study and was done for only a relatively small amount of time. April is a highly variable month and forecasts would be less reliable at this time of year compared to later in the summer. The Simcoe Research Station weather station, while following many the rules for weather monitoring, is not an official Environment Canada station, so there may be some deviation from exact temperatures. This study is meant to provide only a relative comparison between the five sites.

All temperature forecasts and official temperature readings are based on a thermometer placed inside a white louvered box (to keep the thermometer out of the sun but with plenty of air flow) over a mowed grass surface at 1.5 m off the ground and 30 m away from trees, pavement or other obstacles. Keep in mind that thermometers placed closer to the ground will be warmer during the day and colder at night than what is forecast. The Simcoe Research Station weather station thermometer is at 1 m off the ground. Thus, temperatures will be warmer during the day and colder at night on average than official temperature readings.

First of all, here is a comparison of the sites and the information provided by each. Smart phones, radio station and website weather forecasts will usually be based on one of these forecasts.

Environment Canada(http://weather.gc.ca/city/pages/on-161_metric_e.html) (the official weather forecasting service of Canada): 7 day high and low temperature and condition forecasts, official weather advisories and warnings and hourly forecasts for 24 hours for temperature, conditions and wind speeds (click on “Today” in the local forecast). Also provides official historical records for many locations.

Weather Network(<http://www.theweathernetwork.com/ca/weather/ontario/simcoe>): Same as Environment Canada but also 36 hours of dewpoint, wind speed, temperature and condition forecasts. Also provides 14 day forecasts (read further for comments on long range forecasts)

Weather Underground(<https://www.wunderground.com/q/locid:CAXX0457;loctype:1>): Provides 10 days of hourly temperature, wind speed, cloud cover, conditions, rainfall, dew point and humidity forecasts (click on “Table” and then the day you want to view for the details).

Meteoblue(https://www.meteoblue.com/en/weather/forecast/week/simcoe_canada_6147962): Provides 7 days with 3-hour forecast periods for temperature, precipitation, conditions and wind speeds.

Accuweather(<http://www.accuweather.com/en/ca/simcoe/n3y/weather-forecast/54995>): Most of the same information as Weather Underground but hourly forecasts beyond three days require a subscription. Daily high and low temperature forecasts extend to 90 days (read further for comments about long-range forecasts).

Forecasting Frost Events – Comparison of Weather Forecast Sites...con't

To assess the accuracy of a forecast you need to know both how skewed the forecast is on average and how much it deviates from that skew. The skew is the number of degrees (+ or -) that the forecast site is normally off from the actual high or low. So a forecast site with a negative skew is usually underestimating the actual temperature, and a positive skew indicates that it is on average overestimating the actual temperature. The standard deviation is how variable the forecast site is. A high standard deviation indicates that the forecast temperature can be much higher or lower than what was forecast beyond the skew. For example, a forecast low temperature for a day is 0°C. If the skew for that forecast is 2°C and the standard deviation is 3°C then the actual temperature on average will be -2°C and in the range of -5°C to +1°C 50% of the time. The other 50% of the time, the actual temperature will be below -5°C or above 1°C.

A perfect forecast should have low skew and low standard deviation. The next best thing would be a site with high skew but low standard deviation. This is because this would represent a site that is consistently higher or lower than the actual temperature. If you know a site is always 3 degrees higher than it should be, then it is easy enough to correct for that difference.

Average skew (Table 1) and standard deviation (Table 2) values for the five forecast sites are provided. Note that all of the forecast sites over all periods are negatively skewed during the day and positively skewed at night. Some of this skew can be attributed to the fact that the thermometer at the Simcoe Station is closer to the ground than it should be. Even with this in mind, the actual temperatures are usually above the forecast during the day and below the forecast at night. Weather Underground had both the lowest skew and the lowest standard deviation of the five sites for daily high temperature forecasts. Accuweather had the lowest skew for daily low temperature forecasts, but also high variability. Environment Canada had the lowest variability in the daily low temperature forecasts.

When I looked at only those nights with clear skies and calm winds, which are the important nights for predicting frost events, Environment Canada had both the lowest skew and the lowest standard deviation. Even this forecast though, had a standard deviation of 2°C over the one to four day forecast periods and was skewed 2°C warm, which is probably closer to 1°C when you factor in the lower height of the thermometer in Simcoe. So if the forecast low is -1°C, the actual low will on average be about -2°C but between 0°C and -4°C 50% of the time. Some of this variability is probably due to a few forecasts that predicted cloud cover at night when it was actually clear. So in reality, the variability on nights that are known to be clear many days in advance would probably be a lot lower.

Table 1. Average difference (skew) from actual temperatures for five different weather forecasting sites over different forecast periods for Simcoe, Ontario over a one month period in April/May 2016.

Forecast Site	Daily High Temperature Skew (°C)			Daily Low Temperature Skew (°C)		
	1-2 Day Forecasts	3-4 Day Forecasts	5-7 Day Forecasts	1-2 Day Forecasts	3-4 Day Forecasts	5-7 Day Forecasts
Environment Canada	-1.9	-2.3	-2.4	2.0	1.9	2.6
Weather Network	-2.5	-3.9	-4.4	3.0	3.0	4.0
Weather Underground	-1.1	-1.3	-1.5	1.9	2.1	2.9
Meteoblue	-1.7	-1.8	-1.8	1.8	1.8	1.8
Accuweather	-2.1	-2.9	-2.8	1.5	1.5	2.4

Forecasting Frost Events – Comparison of Weather Forecast Sites...con't

Table 2. Average standard deviation from actual temperatures for five different weather forecasting sites over different forecast periods for Simcoe, Ontario over a one month period in April/May 2016

Forecast Site	Daily High Temperature Standard Deviation (°C)			Daily Low Temperature Standard Deviation (°C)		
	1-2 Day Forecasts	3-4 Day Forecasts	5-7 Day Forecasts	1-2 Day Forecasts	3-4 Day Forecasts	5-7 Day Forecasts
Environment Canada	2.5	3.2	3.5	2.0	2.0	2.8
Weather Network	2.6	3.0	3.8	3.7	3.2	3.2
Weather Underground	1.5	2.4	3.7	3.6	3.4	2.7
Meteoblue	1.9	3.1	4.3	2.3	2.9	3.1
Accuweather	1.7	2.5	3.6	3.8	3.5	2.9

Forecasts for the Simcoe area may have higher variability than other locations in Ontario. This is because Norfolk County has very sandy soils that heat faster during the day and cool faster at night than other soils that retain more moisture. This would be especially true in the spring when most fields are bare. Weather models used for forecasting, probably do not account for these local microclimates very well.

All of the sites begin to become very unreliable beyond the 5 or 6 day forecasts. Examining forecasts beyond this period is not useful.

So what is the best site to use? Based on the variability in the forecasts, it is best to look at several forecasts and err on the side of caution. Keep in mind that beyond the variability in the forecasts discussed above, there can be significant local differences in actual temperatures within a small area. Five weather monitoring stations within 5 km of Simcoe over this same period ranged up to 3°C on some of the calm clear nights in the monitoring period.

So what is the best strategy for growers to use when trying to forecast frost events?

1. Look at several different forecast sites and look at the range of forecast low temperatures.
2. Err on the side of caution and assume the worst case scenario.
3. Examine specifically the wind speeds, cloud cover and dew points to give an idea of how low temperatures may go.
4. Keep in mind that temperatures can be significantly lower on the ground than the actual air temperature, and the drier the air, the larger this difference can be. This is important for crops that are close to the ground.
5. Keep track of forecasted low temperatures and your actual low temperatures so you can adjust forecasts to more reliably match your local microclimate over time.