



HORT MATTERS

OMAFRA Specialists in Horticulture and Specialty Crops.

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Getting the Tools of the Trade

Anne Verhallen, Soil Management Specialist

The right tool for the job sometimes makes all the difference. Ever tried to soil sample with a shovel? If you did it correctly it probably took twice the time. Often the challenge is in finding the tool. Here are some suggestions for outlets that carry some of the key soil diagnostic tools (this is just a listing of sources):

Soil thermometers: Often you can find these at the local hardware store but here are some other possible sources.

<p>Lee Valley Tools Ltd. P.O. Box 6295, Station J, Ottawa, ON K2A 1T4 Ph.1-800-267-8767 Fax 1-800-668-1807 www.leevalley.com</p>	<p>Soil and Compost Thermometer</p> <ul style="list-style-type: none"> • Glass thermometer with metal shield – takes a bit longer to reach a reading • Celsius and Fahrenheit scales with a wide range -10° to +110°C • Green tip may make it difficult to see in crop
<p>Berry Hill Limited 75 Burwell Road, St.Thomas, ON N5P 3R5 Ph. 1-800-668-3072 Fax (519) 631-8935 www.berryhilllimited.com</p>	<p>Soil Thermometer</p> <ul style="list-style-type: none"> • Dial type, stainless steel • -1 to 32°C (30 to 90°F)
<p>Marathon Watch Company Ltd. 10 - 30 Mural St., Richmond Hill, ON L4B 1B5 Ph. 905-764-9420 1-800-822-4329 Fax 905-764-0035 info@marathonwatch.com</p>	<p>A variety of digital thermometers available – often this is the brand in local hardware stores.</p>
<p>ThermoWorks (US company) 270 N. Main St. Suite D, Alpine, UT, USA 84004-1440 Ph. 801-756-7705 Fax 801-756-8948 www.thermoworks.com</p>	<p>Variety of digital thermometers</p>

Soil Sampling probes: A little more specialized but the local agricultural supplier may stock them.

<p>Halltech Environmental 129 Watson Road South Guelph, Ontario Ph: (519)766-4568 Fax: (519) 766-0729 www.htex.com</p>	<p>Spectrum Technologies Inc. 23839 W. Andrew Road Plainfield, Illinois USA 60544 1-800-248-8873 www.specmeters.com</p>	<p>Canadian Forestry Equipment Ltd. 4-1540 Trinity Dr Mississauga, ON , L5T 1L6 Ph: 905-795-1610 1-800-387-4940 Fax: 905-795-1632 www.cfe.ca</p>
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Early season frost damage in apples

Kathryn Carter, Pome Fruit IPM Specialist, OMAFRA and Dr. John Cline, University of Guelph

On the evening of April 30-May 1 several apple growing regions in Ontario experienced frosts which will likely result in crop loss. The extent of the damage varies throughout the province with some areas receiving little or no damage, and other areas reporting high levels of injury. The highest level of damage has been reported in the Norfolk and London areas with reports of temperatures reaching as low as -4° or -5° C. The effect of temperature on fruit damage is dependent on the stage of development the crop is at (Table 1).

Table 1. Critical Spring Temperatures for Temperate Tree Fruits										
Compiled by Dr. John A. Cline, Associate Professor, University of Guelph										
	1	2	3	4	5	6	7	8	9	
Apples	Silver Tip	Green Tip	½ inch Green	Tight Cluster	First Pink	Full Pink	First Bloom	Full Bloom	Post Bloom	
10% Kill	-9.4	-7.8	-5.0	-2.8	-2.2	-2.2	-2.2	-2.2	-2.2	
90% Kill	-16.7	-12.2	-9.4	-6.1	-4.4	-3.9	-3.9	-3.9	-3.9	
	1	2	3	4	5	6	7	8		
Pears	Bud Swell	Bud Burst	Tight Cluster	First White	Full White	First Bloom	Full Bloom	Post Bloom		
10% Kill	-9.4	-6.7	-4.4	-2.2	-1.7	-1.7	-1.7	-1.7		
90% Kill	-17.8	-14.4	-9.4	-7.2	-5.6	-5.0	-4.4	-4.4		
	1	2	3	4	5	6	7	8		
Apricots	Bud Swell	Bud Burst	Red Tip	First White	First Bloom	Full Bloom	In the Shuck	Green Fruit		
10% Kill	-9.4	-6.7	-5.6	-4.4	-3.9	-2.8	-2.8	-2.2		
90% Kill	-	-17.8	-12.8	-10.0	-7.2	-5.6	-4.4	-3.9		
	1	2	3	4	5	6	7			
Peaches	Bud Swell	Calyx Green	Calyx Red	First Pink	First Bloom	Full Bloom	Post Bloom			
10% Kill	-7.8	-6.1	-5.0	-3.9	-3.3	-2.8	-2.2			
90% Kill	-17.2	-15.0	-12.8	-9.4	-6.1	-4.4	-3.9			
	1	2	3	4	5	6	7	8		
European Plums	Bud Swell	Side White	Tip Green	Tight Cluster	First White	First Bloom	Full Bloom	Post Bloom		
10% Kill	-10.0	-8.3	-6.7	-4.4	-3.3	-2.8	-2.2	-2.2		
90% Kill	-17.8	-16.1	-13.9	-8.9	-5.6	-5.0	-5.0	-5.0		
	1	2	3	4	5	6	7	8	9	
Sweet Cherries	Bud Swell	Side Green	Green Tip	Tight Cluster	Open Cluster	First White	First Bloom	Full Bloom	Post Bloom	
10% Kill	-8.3	-5.6	-3.9	-3.3	-2.8	-2.8	-2.2	-2.2	-2.2	
90% Kill	-15.0	-12.8	-10.0	-8.3	-6.1	-4.4	-3.9	-3.9	-3.9	
	1	2	3	4	5	6	7	8	9	
Tart Cherries	Bud Swell	Side Green	Green Tip	Tight Cluster	Open Cluster	First White	First Bloom	Full Bloom	Post Bloom	
10% Kill	-9.4	-4.4	-3.3	-3.3	-2.2	-2.2	-2.2	-2.2	-2.2	
90% Kill	-17.8	-12.2	-5.6	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4	

(adopted from These numbers were taken from Washington (WSU), Michigan (MSU) and North Carolina (NCS) Extension Bulletins. Apple - WSU EB0913, Pears - WSU EB0978, Sweet Cherries - WSU EB1128, Peaches - WSU EB0914, Apricots - WSU EB1240, Tart Cherries - MSU Research. Rpt. 220, Washington State University Extension Bulletin 0913)

When frost damage has occurred in your area it can be useful to try to assess the amount of frost damage to apple buds and flowers. Often the extent of frost injury doesn't show up on the blossoms or buds for 2-3 days. The entire extent of the damage to the crop is not usually apparent until after June drop, when you have a better indication of the impact on fruit russetting, malformed fruit, and fruit drop.

Prior to June drop frost damage can be assessed by looking at the pistils of the flowers. If the pistils are black or brown (Fig. 1) the blossom is likely killed.



Figure 1. Browning of floral parts is evident shortly after frost damage has occurred [Photo J. Cline].

It is often necessary to tear the flower or the bud apart to see if the center of the flower (ovary) is brown or black (Fig. 2).



Figure 2. Using your fingers or a small razor blade, cut open the small fruitlet and look for evidence of browning [Photo J. Cline].

When checking apples for frost damage, check the king and side blooms separately. The king bloom is the most advanced and therefore it is the most likely to be affected by frost near bloom.

Frosts and freezes can cause browning and damaged petals especially in varieties like golden delicious. Some apples can make it through frosts, but later in the season can show signs of frost rings or malformation (Fig. 3).



Figure 3. Frost rings and misshapen/malformed fruit are often evidence of earlier frost damage to flowers. Some reliance on hand thinning to selectively remove these unmarketable fruit may be necessary [Photo J. Cline].

Frost damage is important to keep in mind when determining a thinning program and a pest management program for the year. For more information on thinning after a frost refer to Dr. John Cline's article in this issue of Hort Matters.

Chemical Thinning of Apples in the Response to Frost Damage to Flowers

Dr. John Cline, Dept. of Plant Agriculture, University of Guelph

On the mornings of April 30 and May 1, 2008, a widespread frost/freeze may have damaged many tree fruit crops in southern and eastern Ontario. Overnight low temperatures fell to a range of 0.7 to -6.0°C for approximately 3-4 hours each night (Table 1). Although a frost was predicted, the widespread nature, extended period below freezing, and low temperatures has apparently resulted in significant flower damage when many of the peaches and cherries were at the phenological stages of pink to full bloom and apples and pears at half-inch green to pink.

Table 1. Minimum air temperatures (°C) at approximately 1.5 metres from the ground and various locations in Ontario April 30 and May 1, 2008

Location	30-Apr	1-May
Collingwood	0.7	0.7
Delhi	-5.5	-2.3
Guelph	-4.9	-4.1
Hamilton	-3.5	0.2
Harrow	-1.8	5.7
London	-2.4	-3.9
Markdale	-6.0	-3.5
Ottawa	0.1	-1.5
Simcoe	-0.8	-2.7
Stratford	NA	-1.0
Trenton	-0.7	-2.1
Vineland	-1.4	-0.3
Welland	-4.0	NA

Source: Environment Canada

<http://www.climate.weatheroffice.ec.gc.ca>

According to the Washington State University 'Stages of Apples' fact sheet, a temperature of -5.0°C and -2.8°C will result in 10% bud injury to apples at the "½ green" and "tight cluster" stages, respectively. A low temperature of -9.4°C and -6.1°C will result in 90% bud injury to apples at the same stages, respectively. Clearly, many orchards in southern Ontario experienced low temperatures in this range, although damage seems to be more extensive than these guideline temperatures would predict. Preliminary reports from around the province indicate apple bud damage in the 10 to 90% range, depending on block elevation, stage of bloom, and height in the tree, and proximity to the Great Lakes.

Growers are advised to do an assessment of the injury by cutting a sample of buds/flowers in half to see if the developing flowers or fruitlets have been damaged (Figures 1 & 2).



Figure 1. Healthy apple flower unaffected by frost [Photo J. Cline].



Figure 2. King bloom flower with damage to the ovary. Damage to the stigma and style was also evident. Petals seemed unaffected [Photo J. Cline].

Frost-damaged will be evident in the browning of ovary tissue as early as 24-48 hrs after the frost. The king bloom is likely to be more affected, but injury on lateral flower may also be evident. Because injury from a radiation frost can vary widely within an orchard depending on block location, cultivar, and height in tree, blossom buds should be examined throughout the orchard. Frost may also injure spur leaves throughout the tree. When this occurs, absorption of chemical thinners into injured fruit and leaves is likely to be greater than into non-injured fruit and leaves, and therefore the thinning response may be greater. Frost may also impair photosynthesis and the stress caused by reduced carbohydrate supply may also accentuate thinning.

If flower injury is light (less than 30% brown, damaged buds), the potential for a good crop is certainly still there. But, if injury is in the moderate to severe range (greater than 50%) growers should keep a close eye on the important fruit-set period following petal fall. Certainly, significant frost/freezing injury (>60%) will make thinning decisions more complex. If the king-bloom is killed leaving several viable lateral fruitlets, thinning may become more difficult due to less differentiation in size and greater inter competition between lateral fruitlets. In this instance, it may be prudent to wait until fruit sizes differ within the cluster, and once fruit set is more apparent. Apply thinners before the largest fruit is no more than 14-15 mm. When the lower part of the tree canopy is more affected, apply 65-90 % of water volume to the top 1/2 of the tree canopy and consider turning off the lower nozzles on the sprayer. Reliance on some hand thinning may be necessary to selectively remove fruit with frost markings or mis-shapen fruit. Remember, only approximately 5% of flowers are required to set a full commercial crop. If the frost has resulted in significant crop reduction, then you may want to seriously consider controlling growth for the growing season using Apogee. Sprays for this begin at petal fall.



ON Organic

Hugh Martin, Organic Crops Production Program Lead

OMAFRA has a new newsletter – “ON Organic”. As the title suggests it is on Organic issues that are relevant to the Ontario organic sector. This includes production, processing, marketing, certification, etc. So far there has been two issues – April and May. It will be available by email and on the OMAFRA website.

We plan to have one issue per month. I hope they can be short 4-6 pages each issue. There will be articles by numerous authors covering a wide range of commodities and topics. Some articles will be unique to ON Organic and some will be links from other newsletters but relevant to organic producers. In many cases there will be summaries of information with web links to go find the full details.

You can find “ON Organic” at: <http://www.omafra.gov.on.ca/english/crops/organic/news/news-organic.html>. On that page you can download the html or PDF file. You can also subscribe to this newsletter by going to the webpage: <http://www.omafra.gov.on.ca/english/subscribe/index.html#organic>

For example here is the table of contents from the May issue

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