

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

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On the morning of May 13, 2020 (and a few days prior), 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 to -6.1°C for several hours (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 apple trees were at the various stages of bloom.

According to the Washington State University 'Stages of Apples' fact sheet developed for Red Delicious, a temperature of -2.8°C and -2.2°C will result in 10% bud injury to apples at the "tight cluster" and "first" stages, respectively. A low temperature of -6.1°C and -4.4°C will result in 90% bud injury to apples at the same stages, respectively. However, it is not clear how these data differ among cultivars and newer cultivars grown today. Clearly, many orchards in southern Ontario experienced low temperatures in this range. Preliminary reports from around the province indicate flower bud damage has occurred – and this is likely to vary depending on elevation, topography within the orchard, stage of bloom, 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/developing fruitlet in half to see if the developing flowers or fruitlets have been damaged (Figures 1 & 2) and if there are viable seeds.

Table 1. Minimum air temperatures (°C) at approximately 1.5 metres from the ground and various locations in Ontario May 13, 2020

Location	13-May
Barrie	-2.0
Brantford	-4.4
Cobourg	-0.6
Collingwood	-5.4
Delhi	-3.8
Elora	-5.2
Grimsby Mountain	-2.0
Guelph	-6.1
Hamilton Airport	-3.7
Harrow	-1.8
Kingston	-1.1
Kingsville	0.0
Kitchener/Waterloo	-4.4
London	-3.7
Markdale	-7.0
Ottawa	-2.4
Simcoe	-1.9
Stratford	-3.5
Toronto Pearson Airport	-3.0
Trenton	-1.6
Vineland	-0.8
Windsor	0.0

Source: Environment Canada

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



Figure 2. Healthy apple flower unaffected by frost [Photo credit: J. Cline]



Figure 1. King bloom flower with damage to the ovary. Damage to the stigma and style was also evident. Petals seemed unaffected [Photo credit: 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 half 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.