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Disease Management for Fruit Trees After Crop Loss

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Extreme weather events are regular occurrences in the Midwest. Extreme winter cold (below -15°F), late freezes during bloom, hail, and tornados all make tree fruit production challenging. In the event of crop losses from these events, growers still need to manage their trees for diseases. If trees are not managed, disease inoculum can build up and threaten the crop the following season.

Failing to manage for disease can result in defoliated trees that fail to produce fruit the next year or that don't survive the winter. In addition, unsprayed trees can allow disease inoculum (such as apple scab) to build up, making it even more difficult to manage disease (and protect the crop) the next season.

This publication focuses on low-cost methods to manage tree fruit diseases to maintain tree health and protect future crops after the current year's crop is lost.

Photo by Peter Hirst

Figure 1. *Freeze damage on an apple flower bud after the Easter freeze of 2007. Note the dead pistil in the center of the flower.*

Plant Hardiness

Most fruit crops planted in Indiana are fairly cold tolerant when they are fully dormant. In the spring, fruit trees lose their cold hardiness as they develop — when buds swell and new growth emerges. In fact, as the buds and flowers develop, trees become more susceptible to freezing temperatures (Table 1).

This is especially true of flower buds (Figure 1). Temperatures lower than 25°F will cause severe damage and often result in crop loss if trees are in bloom. Early blooming fruit crops (apricot, sweet cherry, peach) are more likely to be damaged due to the higher risk of frost occurring earlier in the spring.

Severe winters can kill some less hardy varieties when planted in northern Indiana (for example, nectarines, pluots, apriums). Harsh winters can also kill young trees or vines that were prevented from achieving dormancy because of excessive fertilization.

Table 1. *Critical spring temperatures for tree fruit. Table originally compiled by Mark Longstroth, Michigan State University Extension, www.canr.msu.edu/vanburen/fruitfreeze.pdf.*

Pome Fruit									
Apples	**Silver Tip**	**Green Tip**	**½-inch Green**	**Tight Cluster**	**First Pink**	**Full Pink**	**First Bloom**	**Full Bloom**	**Post Bloom**
Old temp	16	16	22	27	27	28	28	29	29
10% kill	15	18	23	27	28	28	28	28	28
90% kill	2	10	15	21	24	25	25	25	25
Pears	**Bud Swell**	**Bud Burst**		**Tight Cluster**	**First White**	**Full White**	**First Bloom**	**Full Bloom**	**Post Bloom**
Old temp	18	23		24	28	29	29	29	30
10% kill	15	20		24	25	26	27	28	28
90% kill	0	6		15	19	22	23	24	24
Stone Fruit									
Apricots	**Bud Swell**	**Bud Burst**	**Red Tip**	**First White**	**First Bloom**		**Full Bloom**	**In the Shuck**	**Green Fruit**
Old temp	--	23	--	25	--		28	--	31
10% kill	15	20	22	24	25		27	27	28
90% kill	--	0	9	14	19		22	24	25
Peaches	**Bud Swell**	**Calyx Green**	**Calyx Red**		**First Pink**		**First Bloom**	**Full Bloom**	**Post Bloom**
Old temp	23	--	--		25		--	27	30
10% kill	18	21	23		25		26	27	28
90% kill	1	5	9		15		21	24	25
European Plums	**Bud Swell**	**Side White**	**Tip Green**	**Tight Cluster**	**First White**		**First Bloom**	**Full Bloom**	**Post Bloom**
Old temp	--	--	--	--	23		27	27	30
10% kill	14	17	20	24	26		27	28	28
90% kill	0	3	7	16	22		23	23	23
Sweet Cherries	**Bud Swell**	**Side Green**	**Green Tip**	**Tight Cluster**	**Open Cluster**	**First White**	**First Bloom**	**Full Bloom**	**Post Bloom**
Old temp	23	23	25	28	28	29	29	29	30
10% kill	17	22	25	26	27	27	28	28	28
90% kill	5	9	14	17	21	24	25	25	25
Tart Cherries	**Bud Swell**	**Side Green**	**Green Tip**	**Tight Cluster**	**Open Cluster**	**First White**	**First Bloom**	**Full Bloom**	
10% kill	15	24	26	26	28	28	28	28	
90% kill	0	10	22	24	24	24	24	24	

Stone Fruits

Late spring freezes and severe winter cold regularly cause stone fruit crop losses approaching 100 percent (Figure 2). With this level of irregular cropping, disease management must focus on (1) protecting foliage to ensure a good potential crop for next year, and (2) reducing overwintering spore loads.

In any case, it is important to manage stone fruit trees for diseases even after crop loss. Disease management maintains tree health and protects future crops. Some less expensive fungicide options include:

- Captan® at 1.3 lbs./100 gallons should sufficiently control brown rot twig blight, scab on peaches, and cherry leaf spot. If the season is excessively wet, higher rates of Captan® may be required. Captan® will not control powdery mildew.

Photo by Janna Beckerman

Figure 2. *Late spring freezes often cause 100 percent losses to stone fruit crops.*

Photo by Janna Beckerman

Figure 3. *The fire blight bacterium can infect "rat tail" blooms in apple trees.*

- Wettable sulfur at 6 lbs./100 gallons is probably the least expensive material you can use and provides excellent control of powdery mildew of all stone fruit. Wettable sulfur should help control brown rot twig blight and peach scab.
- Use Flame Out® (oxytetracycline) or Mycoshield® to control bacterial spot on peaches, particularly if the weather is wet in late June and in July.
- Copper is fairly phytotoxic to peaches and should be avoided. Bravo® is a low-cost alternative if disease pressure becomes high, but fruit is absent.

Apples

Freeze loss in apples is unusual, but can occur. Early flowering varieties, such as Gala and PaulaRed, are more susceptible than later flowering cultivars such as Rome, Golden Delicious, and Winesap.

Although a freeze may have damaged or destroyed the apple crop, growers still must manage their trees for diseases, particularly for fire blight and apple scab. Improper disease management (or none at all) after freeze damage can profoundly affect not only this year's harvests, but future harvests, too.

After a freeze, carefully evaluate the status of the crop and apply a lower-cost protectant fungicide (such as captan or mancozeb) until it's clear how much of the crop has been lost. Even after the severe freeze of 2007, many growers were surprised that they were able to harvest 30 to 70 percent of the crop for some varieties, and even 100 percent for late blooming varieties such as Sweet 16, Golden Delicious, and Wealthy.

According to prevailing wisdom, dead flowers that persist on the tree are not good hosts for the fire blight bacterium. However, the fire blight bacterium can infect any escaped side blossoms, later developing blossoms, or "rat tail" blooms (abnormally late flowers after normal bloom) that are still alive (Figure 3). Continue monitoring the crop until bloom is over, and apply streptomycin as needed, not to exceed four applications per season. To improve the timing of streptomycin applications, Washington State University provides an online fire blight risk assessment tool called Cougarblight at www.ncw.wsu.edu/treefruit/fireblight/2000f.htm. Maryblyt is a Windows-based application developed by West Virginia University-Kearneysville and is available at www.caf.wvu.edu/kearneysville/maryblyt.

Freeze or frost injury, like hail injury, damages young and succulent shoots and leaves, which are then susceptible to shoot blight caused by the fire blight bacterium. Use Cougarblight or Maryblyt to monitor the potential for infection by the fire blight bacterium. Even if these tools predict a low potential for infection, you may wish to protect some of the most susceptible varieties, like Fuji, Gala, and Ida Red, especially if these are grafted on M.26, M.27 and M.9 rootstocks. Purdue Extension publication BP-132-W, *Fruit Diseases: Disease Susceptibility of Common Apple Cultivars* (www.extension.purdue.edu/extmedia/BP/BP-132-W.pdf) lists apple varieties and their susceptibility to diseases.

Use streptomycin if there is a crop and no resistance issues, and apply streptomycin before anticipated rain and warm weather during bloom and on rat-tail bloom to protect trees from fire blight. If there is no crop, a low rate of copper (0.2 -0.6 lb. of metallic copper/ acre depending on tree row volume) should provide protection against fire blight. Be careful: copper can russet fruit, and can injure some varieties, so apply copper after temperatures are above 50°F to prevent phytotoxicity. Suggested coppers include Cuprofix®, Kocide®, or C-O-C-S®. If you are worried about possible injury to a copper-sensitive variety, use streptomycin instead.

If you still have a crop, plan on applying streptomycin before anticipated rain when accompanied by warm weather during bloom and on rat-tail bloom to protect trees from fire blight.

If your orchard has a history of fire blight, consider applying Apogee® (prohexadione-Ca). Apogee® is a growth regulator that does not directly kill the fire blight bacterium, but reduces shoot growth, thereby increasing plant resistance by reducing host vigor. When applied near petal fall, Apogee® suppresses apple shoot growth as a single spray, or as several applications over time. Apple response

to Apogee® depends on the cultivar, timing, rate of application, crop load, and geographical location. Regardless of this variability, Apogee® remains the best management tool available for controlling the shoot blight phase of fire blight after a freeze. Recommendations and rates for Apogee®, are provided in Purdue Extension publication ID-168, *Midwest Tree Fruit Spray Guide*, available from the Purdue Extension Education Store, www.the-education-store.com.

Despite the potential or real loss of crop, it is imperative to maintain a least a minimum spray program to control important diseases such as apple scab, powdery mildew and cedar-apple rust. Failure to do so will result in defoliated trees that fail to produce next year, or may not survive next winter. In addition, non-sprayed trees will result in the build up of apple scab inoculum in the orchard and make management of next year's crop that much more difficult. This will be an additional problem to face next year and may threaten the production of future crops. A minimum spray program to protect apple trees after crop loss would require:

- EDBC fungicide program (3 lbs./acre) through bloom. Alternate with copper or sulfur from first cover onward to remain under label limits. Remember to stay within the 21.0 lbs./acre/season limit for EBDCs. EBDCs also protect against bitter rot, black rot, and white rot. Use this schedule if cedar-apple rust is a particular problem, as Captan® is not effective against any of the juniper rusts.
- Alternatively, Captan® can be used earlier in the season for good scab control instead of EBDCs, but Captan® does not control rust or powdery mildew.

  NOTE: Do not use Captan® (any formulation) in combination with, closely following, or in alternation with wettable sulfur products, dodine, or oil. Sulfur-sensitive varieties of apples such as Red Delicious, Staymen, and Baldwin can suffer severe injury and defoliation. Captan 50WP® has a 64-pound per acre per year limit; Captan 80WP® has a 40-pound per acre per year limit.

If the crop is 100% lost:

- Apply copper (at 0.2-0.6 lb. metallic copper/acre based on tree row volume) plus sulfur (6-30 lbs./acre depending on product and formulation) every 10-14 days until the first week of June or later, depending on weather. Summer cover sprays could be applied on a 14- to 21-day schedule (10 to 14 days if excessively wet) to help control secondary scab.

This spray program protects against scab and mildew. Remember, copper can russet fruit and should not be used if you want to use your crop for anything except cider. Do not use sulfur if temperatures are going to exceed 90°F or drying conditions are extremely poor. Do not use sulfur or copper within two weeks of an oil application. Neither of these programs is going to provide complete scab control but should reduce leaf infections. Organic trials in both Michigan and North Carolina regularly apply 6 lbs. of sulfur per treatment without any reported phytotoxicity due to temperature.

In the event that powdery mildew is particularly bad, consider applying a sterol inhibitor (such as Indar®, Rally®, or Rubigan®), or a strobilurin (such as Flint®, Sovran®, or Pristine®) prior to second cover. This should provide some protection against cedar apple rust, too. Due to cost and the potential of no return on investment, growers should avoid using these fungicides if they are experiencing significant loss. It simply is not cost effective to apply these products when there is no crop, nor is it worth risking resistance development by applying these products.

Reference to products in this publication is not intended to be an endorsement to the exclusion of others that may be similar. Persons using such products assume responsibility for their use in accordance with current directions of the manufacturer.

Other publications in the Fruit Diseases *series are available from the Purdue Extension Education Store, www.the-education-store.com.*