



Easter Freeze Effects on Fruit and Nut Crops

Photo courtesy: Chris Evans,
River to River CWMA, Bugwood.org

By John Strang

The Easter freeze of 2007, which extended over five nights from April 5 to 9 was a particularly trying freeze for Kentucky fruit and nut growers. Temperatures during the two weeks preceding the freeze often reached 80°F and advanced floral developmental stages two to two and a half weeks ahead of normal. These temperatures also made the new growth particularly tender. Kentucky as well as a good portion of the Midwest experienced a series of advective freezes, when a cold polar air mass moved into the area with considerable wind. It is very difficult to protect flowers from this type of freeze. Because there is no inversion, heat if supplied, will not stay in the orchard, and overhead sprinkling is worthless because of excessive evaporative cooling from the wind. Some strawberry growers who use matted rows raked the straw mulch back over their plants and achieved fairly good protection, and some of the few strawberry growers who use plasticulture covered their plants with a floating row cover, sprinkled over the row cover, and achieved excellent protection.

Temperatures dropped below the critical temperatures for 90 percent kill (see Table 1) for the floral stages of development for the major tree fruit crops often on two and sometimes three nights. Not only did the temperature drop below the critical temperatures, but it stayed there for six to eight hours on some nights, increasing injury. Injury was also increased by the wind, which accelerated the freezing rate.

Average crop estimates across the state are shown in Table 2. Losses varied across the state because floral development in western and southern Kentucky was a week or more ahead of Lexington, and Lexington was about a week more advanced than northern Kentucky. Additionally, a few areas like Owensboro were slightly warmer than other areas of the state. Pollination weather following the freeze was generally good.

Tree Fruit

Apple injury varied by variety from a 100 percent crop loss to essentially no crop loss on very few varieties because some varieties bloom later than others and some varieties had a wide range of floral developmental stages on the tree at the time of the freeze. Growers report that varieties that had better levels of survival were Pink Lady, Arkansas Black, Honeycrisp, Golden

Table 1. Low temperatures (°F) recorded across the state at Kentucky weather stations from the western to the eastern portions of the state for designated evening dates. Note: Orchard temperatures in rural areas are often a degree or two colder than these.

| Station | April 5 | April 6 | April 7 | April 8 | April 9 |
|----------------|---------|-----------|------------------------|-----------|-----------|
| Mayfield | 30 | 26 | <u>22</u> ¹ | 24 | 28 |
| Paducah | 33 | 30 | 23 | 23 | 30 |
| Princeton | 30 | 28 | <u>22</u> | <u>22</u> | 27 |
| Henderson | 31 | 28 | <u>22</u> | <u>22</u> | 27 |
| Hardinsburg | 28 | 26 | 24 | 27 | 30 |
| Bowling Green | 30 | 27 | 24 | 28 | 42 |
| Glasgow | 28 | 24 | 19 | <u>22</u> | 26 |
| Campbellsville | 29 | 24 | <u>20</u> | <u>22</u> | 25 |
| Bardstown | 28 | 24 | <u>20</u> | <u>22</u> | 25 |
| Louisville | 28 | 25 | 24 | 24 | 27 |
| Somerset | 30 | 26 | <u>20</u> | 21 | 26 |
| Berea | 32 | 27 | <u>22</u> | 25 | 28 |
| Lexington | 28 | 24 | <u>22</u> | 24 | 26 |
| Spindletop | 27 | 23 | <u>22</u> | 24 | 26 |
| Williamstown | 28 | 24 | 24 | 26 | 28 |
| Covington | 27 | 24 | 26 | 28 | 28 |
| Grayson | 30 | 26 | 24 | 28 | 30 |
| Huntington | 30 | 26 | 24 | 28 | 30 |
| London | 30 | 26 | <u>20</u> | 21 | 26 |
| Jackson | 28 | 24 | 21 | 25 | 30 |
| Quicksand | 30 | 26 | <u>22</u> | 24 | 28 |
| Cumberland Gap | 30 | 26 | <u>22</u> | 24 | 28 |

¹ Bolded underlined temperatures are generally below the 90% kill level for tree fruit crop flowers.

Delicious, Enterprise, Gala, Jonathan, Grimes Golden, Gold Rush, Granny Smith, and Lodi. Frost marking and ringing is often found on surviving fruit. Pear injury was very serious, and there will be no crop on European and Asian pears. Asian pears sustained serious wood damage on smaller caliber twigs and shoots (Figure 1). A total crop loss occurred for peaches, plums, cherries, and pawpaws. The exceptions are a full peach crop on a few varieties in Daviess and Boone counties along the Ohio River. There is very little variation in bloom time between blooms on the same tree and between varieties with these crops. American persimmons have very few surviving fruit, and wood injury is evident on smaller caliper growth.



Figure 1. Asian pear spring freeze injury to young twigs. Photo courtesy: John Strang

Small Fruit

All grape varieties suffered damage. The extent of the damage was determined by the vineyard location, variety, species, pruning date, and vine management the previous season. Northern Kentucky growers generally fared the best because their vines were less developed at the time of the freeze. Western Kentucky growers, who have largely planted French-American hybrids that have fertile secondary and latent buds, also

| Table 2. Projected fruit and nut crops expected following the Easter freeze. | |
|------------------------------------------------------------------------------|--------------------|
| Crop | Projected Crop (%) |
| Apples | 5% |
| Pears | 0% |
| Peaches | 2% |
| Plums | 0% |
| Cherries | 0% |
| Pawpaws | 0% |
| American Persimmons | 2% |
| Grapes | 50% |
| Blackberries | 40% |
| Raspberries | 90% |
| Blueberries | 10% |
| Strawberries (matted row) | 30-40% |
| Pecans | 5% |
| Hickories | 5% |
| Black Walnuts | 40% |
| Butternuts | 10% |
| Heartnuts | 0% |
| Persian Walnuts | 0% |
| Chinese Chestnuts | 50% |

have better crops. Young vinifera vines that had been planted this spring prior to the freeze were seriously injured, and many have been replaced. Blackberries sustained serious flower losses during the freeze, but many surviving flowers set fruit. Cane injury also occurred in blackberries, but cane collapse due to high temperatures and drought has not been as severe as projected earlier. Thus, a moderate blackberry crop is anticipated. Raspberries appear to have come through the freeze with some crop loss to June-bearing varieties and no crop loss to fall-bearing varieties. New shoots arising from the ground have been killed on fall-bearing varieties, but these have regenerated and should produce a full crop. The blueberry crop was severely injured, and this crop is one that rarely fails to produce fruit. Early-maturing varieties such as Duke bloom earlier and, like many other varieties, lost their entire crop. In the UK-Lexington variety trial, there are very few fruit. The leaves on some experimental rabbit-eye and southern highbush blueberries have been killed, and the plants have sustained serious wood injury as well as tip dieback. However, the exceptionally late-maturing and blooming varieties Elliot and Aurora have a full crop. A few growers in the Henderson area and in northern Kentucky had very good flower bud survival due to warmer temperatures and slow floral development, respectively. Some fruit show frost rings. Matted-row strawberries produced only 30 to 40 percent of a full crop. Most primary flowers were killed, and these produce the largest berries, representing about 30 percent of the crop yield. Additionally, many of the secondary flowers were also killed. Thus, berry size was small and picking slow. Later blooming strawberry varieties mature fruit later, and these performed a little better.

Nut Crops

The new shoot tips, which contained the flowers, of pecan and both shellbark and shagbark hickory were killed. Injury is particularly apparent in the southwest and western portion of the state, where trees were very slow to refoliate. Black walnuts fared a little better, and a 40 percent crop is projected. Black walnut bud development is delayed

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Figure 2. Persian walnut limb dieback from spring freeze, Lexington, Kentucky. Photo courtesy: John Strang

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compared with other nut crops, and some varieties such as Thomas Myers, which buds out particularly late, have partial crops in central and northern Kentucky. Butter-nuts lost most of their crop, and heartnut flowers did not survive the freeze. Persian (English and Carpathian) wal-nut trees received serious wood damage to both young growth and older limbs (Figure 2). The one exception is the Allegheny variety that foliates later in the spring, and it has a crop. Chinese chestnuts showed injury to many buds following the freeze; however, many lateral buds survived. Chestnuts flower late; they have produced a lower than normal crop of male flowers, and many of these have female flowers at their bases. Thus, a half crop of Chinese chestnuts is projected.

It will be important this season to provide good weed control and irrigation for those plants that were seriously injured by the Easter freeze. Care this season will enable the plants to produce a good crop for 2008.

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