



Assessing Freeze Damage in Pear Buds

Todd Einhorn, David Gibeaut, Janet Turner, and Steve Castagnoli
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1. Collect fruiting spurs and place in a warm location (room temperature), for one to two hours.
2. Cross-section the buds by slicing horizontally through the widest point of the bud (roughly half the distance from the tip to the base) with a sharp knife or razor blade.
3. Observe under a 10x hand lens (loop). Depending upon the extent of injury, bud development stage, and sampling method, damage may be observable with the naked eye.



Figure 1. The image at left shows a branched pear spur. Each of the two branches terminates in a bud. The open bud on the left (at about stage 6 to 7) has 6 flowers and 4 leaves. Pear buds are compound and mixed. They have both vegetative parts (leaves; bourse shoot), and floral parts in the same bud. This is different than stone fruit, which have simple buds (i.e., the bud is either floral or vegetative).



Figure 2. Three cross-sections of a single, non-injured pear bud sliced to different depths, and imaged at 10x magnification (i.e., magnification power of most hand lenses). The individual flowers within a bud are at different developmental stages, and will vary in their size, shape, and relative height when sectioning the bud. The image at left shows a shallow slice made just below the tip of the bud revealing accessory tissue (flower parts are not yet visually apparent). The center image shows a deeper cut revealing six individual flowers, each with its tip barely removed. Pink anthers (male part of the flower containing the pollen) can be seen in the two center flowers, and barely evident on the far left flower. The right image shows the same six individual flowers; four are now cut through the ovaries, and two show anther sacs.



Figure 3. Pear buds subjected to -13 °F in a freeze chamber for one hour, then held at room temperature for different durations prior to being cut and imaged at 10x. The bud to the left was cut and imaged after being held at room temperature for ten minutes. Center bud was cut and imaged following 30 minutes exposure to room temp. The bud on the right was cut and imaged following 2 hours and 30 minutes exposure to room temp. Activity of the enzyme(s) responsible for tissue browning require(s) heat in order to oxidize the compounds released from the damaged cells. **When buds are cut in the field following a freeze event, and not provided adequate time to warm, tissue injury will not likely be detectable (photo on the left), even though the cells are dead.** Depending upon the temperature of the frost event, specific tissues or organs may be differentially affected. In these cases, portions of the bud will appear brown, while other portions remain green.



Figure 4. Cherry reproductive bud for comparison. Two of the four flowers in the bud were killed from a freeze event. In each flower the anthers and the pistil (severed tissue in the center of each flower) can be seen. This bud likely had the potential to set two fruit.

No formal sampling protocol exists for collecting spurs from orchards for assessing bud damage. Sampling 100 spurs collected randomly from a block would provide an overall picture of damage and the potential for reduced crop. Alternatively, samples could be collected from specific areas of the orchard to determine the range in extent of damage.