Fruit (and grape) bud cold hardiness, western Colorado, 2007.

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Dormant buds were collected during the morning from fruit trees growing in the Cedaredge and East Orchard Mesa area. Buds were taken from shoots of moderate vigor that had no obvious sign of damage. Shoots were then transported to the Western Colorado Research Center - Orchard Mesa, placed in a shaded area outdoors, and kept outside overnight. The next morning shoots were placed into a programmable freezer. The starting temperature for the freezing program was altered depending on the outside temperature just prior to moving the shoots to the freezer. For example, on 28 November the outside temperature at time of the bud collection was ~28 °F, so the freezing program was initiated at a freezer temperature of 28 °F. Irrespective of the starting temperature, the freezer was programmed to reduce the temperature by 5 °F over a 30 minute interval, and then hold at that temperature for 30 minutes. This cycle was repeated until the threshold temperature for a sample was reached. At the end of the holding period for that threshold temperature sample shoots were removed, temperature decreased by 5 °F over 30 minutes and held for 30 minutes, etc. After removal from the freezer, buds were left at room temperature for a minimum of 24 hours and then cut open to evaluate the tissue. Buds showing vibrant green tissue were judged to be viable whereas buds showing brown tissue were judged to be dead (see Figs. 2 and 3).

Cold hardiness is influenced by many different factors, including variety, crop load, harvest time and post-harvest conditions, and orchard weather conditions. There is a genetically determined limit to cold hardiness. However, while this is true for mid-winter hardiness, the ranking might be different at the start or end of the dormant season. Some varieties will acclimate earlier in fall and will be able to withstand colder temperatures earlier in the dormant season than varieties that have otherwise more mid-winter hardiness. Likewise, early bud-breaking varieties tend to loose their hardiness earlier in spring and might be damaged at warmer temperatures than late-breaking varieties, irrespective of their mid-winter hardiness. Also, cultural practices can have a profound influence if the genetic potential of a particular variety is achieved.

In very general terms, warm temperatures tend to reduce bud hardiness while cold temperatures tend to induce more hardiness (within limits). Hence, the weather conditions at a site will influence the ability of buds to withstand cold temperature, and the values presented in Table 1 are in part affected by the temperature conditions at that site (see Fig. 1). The data presented here is for information only, and growers should make their own assessment.

Table 1: Percentage of **live** fruit buds as affected by temperature. Most recent update in red.

Location	Crop	Variety	Date	Control	0 ºF	-5 ºF	-10 ºF
Cedaredge	Peach	Cresthaven	28 Nov 2007	100	99	89	10
Cedaredge	Peach	Newhaven	28 Nov 2007	100	100	93	7
Palisade (EOM)	Peach	Cresthaven	28 Nov 2007	100	99	94	65
Palisade (EOM)	Peach	Newhaven	28 Nov 2007	100	93	88	43

Last update: 29 November 2007

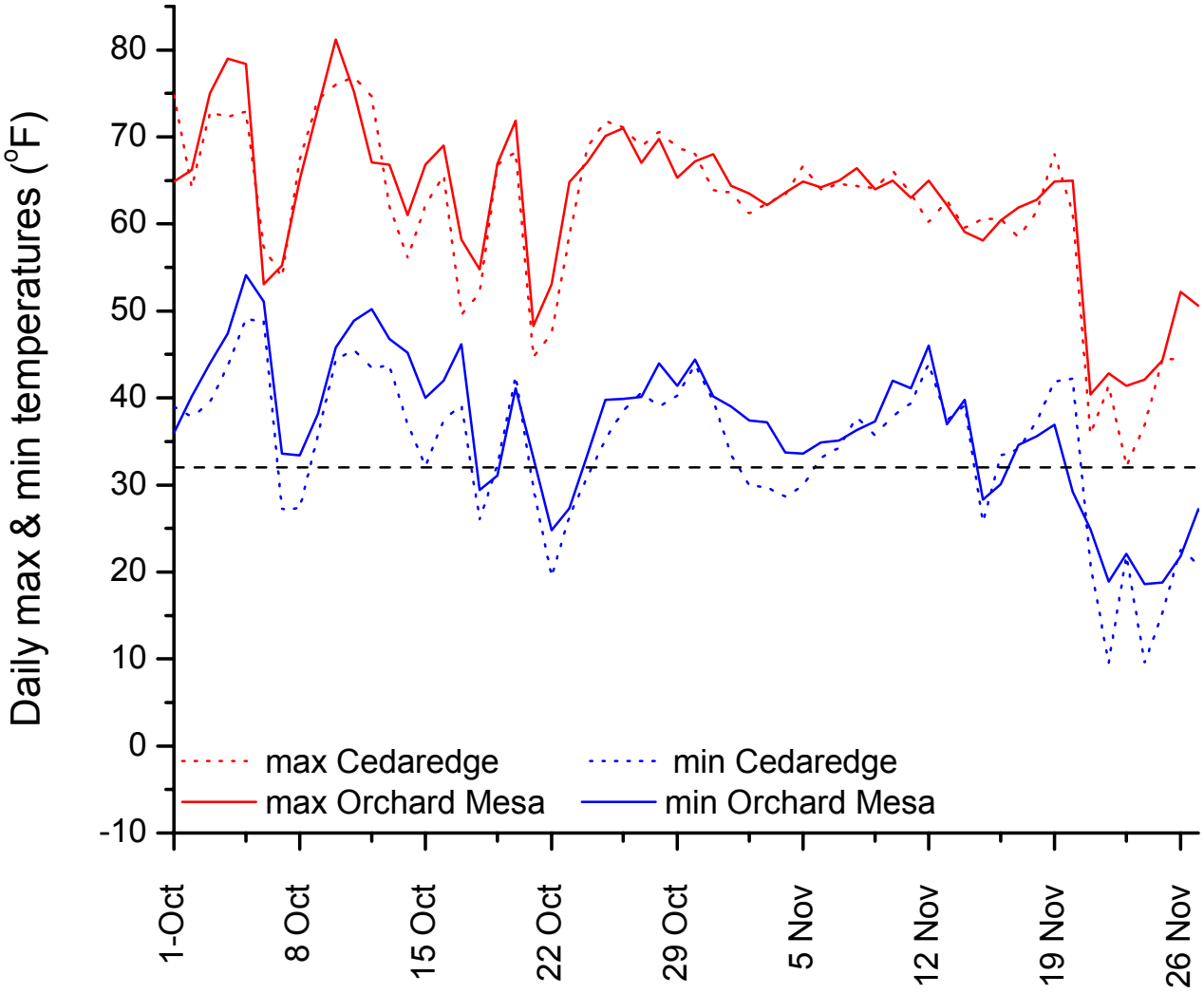

Fig. 1: Daily maximum and minimum temperatures recorded at a commercial orchard near Cedaredge, Colorado, and the Western Colorado Research Center - Orchard Mesa near Grand Junction, Colorado. Temperature data for various locations within the Grand Valley can be found at www.rmavv.org/weather.php

Buds can be assessed for damage by cutting them (using a single-edged razor blade) and looking for browning of the ovary (or, in the case of multi-flower buds such as in cherry, ovaries). Figures 2-3 show live and dead buds of BerendaSun and Cresthaven peach, respectively, where the dead buds are from shoots placed in a chest freezer (approx. –10 ºF) for 50 minutes. Figure 4 shows a bud cluster from Bing sweet cherry collected at the Western Colorado Research Center - Rogers Mesa the morning of 30 November 2006 after an overnight low of –9.9 ºF; some of the ovaries within some buds are dead while others survived. Severe damage results in more pronounced, deeper browning of damaged or killed tissues. Less severe damage may produce slightly browned tissues. The brown coloration is the result of phenolic compounds being released in the damaged tissues. Shoots from the orchard need to be held for a minimum of 24 hours at 70 °F (room temperature) before cutting in order to maximize pistil browning.

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Fig. 2: BerendaSun peach. Left: live fruit pistils (arrows); right: dead fruit pistils (arrows).

Fig. 3: Cresthaven peach. Left: live fruit pistils (arrows); right: dead fruit pistils (arrows).

Fig. 4: Bing cherry. Left: multiple-flower bud with three live pistils (arrow); right: multiple-flower bud with two live pistils and one dead pistil (arrows).