Upcoming Freeze

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Mary Concklin, Extension Educator - Fruit Production & IPM
UConn IPM Program Coordinator

Many stone fruits have green tissue showing and are in the line of fire for cold temperature damage, Monday morning, Tuesday morning and, in some parts of the state, Wednesday morning when low temperatures are predicted to be in the low 20s to high teens. This is an arctic cold mass with winds above 10 mph. No temperature inversion will be present. Strawberries are the only berry crop where some damage could occur with growth already underway although flower buds are not evident yet. Crown damage could occur.

Critical temperatures are the lowest temperature the plant tissue can endure for 30 minutes or less without damage occurring. This critical temperature varies with type of fruit, stage of bud development, and cultivar for a specified injury level, such as 10% and 90% bud kill.

All buds are not equal in temperature hardiness at a particular time because they did not develop at precisely the same rates. The position of the bud in the tree or plant influences the temperature around the bud. A bud sheltered on the underside of the limb or under a leaf may be warmer than one exposed to the cold night air. These differences between buds and the length of exposure to low temperatures results in varying degrees of bud kill. Injury to foliage early in the season, observed as curled or wrinkled leaves, results from the destruction of cells and subsequent separation of the lower epidermis from the mesophyll. Deciduous fruit are most susceptible to low temperature injury in the bloom to fruit set stages. However, damage to seeds and ovules can occur at any stage of bud, blossom, and fruit development.

Generally, the first visible sign of frost injury is browning of the petals. Plant tissues that slowly cool to below the critical temperature without ice formation, and slowly re-warm to above the critical temperature may sustain little or no injury.

This chart is for strawberries.

Stage of Development	**Critical Temperature (^{0}F)**
Bud emergence	10.0
Tight bud	22.0
Popcorn	26.5
Open blossom	30.0
Fruit	28.0

Source: Perry, K.B. and E.B. Poling. NCSU.1986. *Field observation of frost injury in strawberry buds and blossoms.* Advances in Strawberry Production 5:31-38

UTAH PESTS fact sheet

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Critical Temperatures for Frost Damage on Fruit Trees

Marion Murray, IPM Project Leader

The following table, developed by Washington State University, lists Fahrenheit temperatures for each stage of development at which 10% and 90% bud kill occurs after 30 minutes exposure. The percentage bud kill which causes crop reduction will vary with each crop. For example, to have a full crop of cherries requires well over 50% bud survival in most years, while apples, pears, and peaches may only need 10-15% bud survival.

APPLE

	Silver Tip	Green Tip	Half-Inch Green	Tight Cluster	First Pink (Pink)	Full Pink (Open Cluster)	First Bloom (King Bloom)	Full Bloom and Post-bloom
10%	15	18	23	27	28	28	28	28
90%	2	10	15	21	24	25	25	25

PEAR

	Swollen Bud (Scale Separation)	Bud Burst (Blossom Buds Exposed)	Green Cluster (Tight Cluster)	White Bud (First White, Popcorn)	Full White	First Bloom (King Blossom)	Full Bloom	Petal Fall (Post-bloom)
10%	15	20	24	25	26	27	28	28
90%	0	6	15	19	22	23	24	24

APRICOT

	First Swell (Bud Swell)	Tip Separation (Swollen Bud)	First White	First Bloom	Full Bloom	In the Shuck (Petal Fall)	Shuck Split (Post-bloom)
10%	15	20	24	25	27	27	28
90%	—	0	14	19	22	24	25

CHERRY

SWEET	Swollen Bud (First Swell)	Bud Burst (Green Tip)	Tight Cluster	White Bud (First White, Popcorn)	First Bloom	Full Bloom	Post-bloom
10%	17	25	26	27	28	28	28
90%	5	14	17	24	25	25	25
TART							
10%	15	26	26	28	28	28	
90%	0	22	24	24	24	25	

PEACH NECTARINE

	Swollen Bud (First Swell)	Calyx Green	Quarter-Inch Green (Calyx Red)	Pink (First Pink)	First Bloom	Full Bloom	Post-bloom
10%	18	21	23	25	26	27	28
90%	1	5	9	15	21	24	25

PLUM	Swollen Bud	Side White	Green Tip	Tight Cluster	First White	First Bloom	Full Bloom	Post-bloom
10%	14	17	20	24	26	27	28	28
90%	0	3	7	16	22	23	23	23

What you can do

Strawberries: Research has shown that using two layers of a 1 oz weight ***row cover*** provides somewhat better frost protection than a single layer of 2 oz cover, likely due to air between the layers. Heavier covers (3-4oz) work for frost protection but restrict light too much and need to be removed as soon as temperatures are above freezing. Avoid placing plastic over the rows unless it is suspended and will not touch the plants. Wherever the plastic touches the plant – leaf, flower – the plant tissues will be killed in freezing temperatures.

All Fruit: ***Over-head watering****:* Over-head watering works based on the principle of latent heat of fusion – as water turns to ice, heat is released. This heat maintains the plant tissue at just above freezing. If at any time during the night the water stops while the temperature is below freezing, the process reverses – heat is removed from the plant tissue and the tissue will freeze. To avoid this, watering must continue until the air temperature rises above 32^0F and the ice has started to melt.

Over-head watering may be combined with the use of row covers or used independently and requires a calibrated emitter system to be sure the required amount of water is constantly being provided. Positives – proven track record of maintaining the temperature of the plant tissue and flower buds above critical temperatures. Negatives – may lead to saturated soils and root diseases; if the water stops at any point when the air temperature is below the 32^0F the buds will freeze.

Return Stack Heaters*:* Heaters hold approximately five gallons of fuel with 20-40 heaters needed per acre. Keep in mind that with a wind the heat will move out of the field. If this were going to be a frost with a temperature inversion. Heaters would be effective with wind machines. In that case, avoid large fires (bonfires) as these will penetrate the inversion layer allowing the heat to leave the fruiting zone. When that happens, the only place there will be heat is right next to the fire. Light every second or third heater initially and then light the rest. This will allow heat to begin moving through the field without a big burst of heat that may puncture the inversion layer.

Wind machines: With winds at or above 5 mph, and no temperature inversion, wind machines will not be effective in warming orchards.

More detailed information of frost, freeze and protection methods can be found here.

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