Frost & Freeze Information: April 1, 2016
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The forecast for the early part of next week is not good:
Sunday night - low of 26, winds 10-20, decreasing to 5 mph
Monday night – low of 27, chance of rain or snow, winds 10-15 mph
Tuesday night – low of 17-21, winds 10-18 mph

Obviously these lows will vary somewhat across the state as well as in traditionally low pockets. And with any luck the forecasters will be wrong and the temperatures will not drop as much. Temperatures in the mid to high 20’s should not create much of a problem based on our bud stages, but Tuesday’s predicted temperatures in the teens will be a problem. Not only is the low temperature going to create problems, but the sustained winds will make it difficult to use many active frost protection methods effectively.

Are we going to be dealing with a frost or a freeze?
**Advection freeze:** A cold air mass, frequently a dry artic air mass, with temperatures at or below 32°F, usually accompanied by winds in excess of 5 mph, with or without cloud cover. No temperature inversion exists. Only passive frost protection methods have a chance of working.

**Radiation frost:** Characterized by calm winds and clear skies, a temperature inversion develops, and cold air drains to the lowest points in the field. Temperatures at or below 32°F. Frost protection methods work best under these conditions.

**Bud Stages** across the state:
Apples – dormant to early HIG
Pears – dormant to early TC
Peaches – leaf buds exposed
Apricots – swollen bud to red calyx
Plums – GT to TC
Cherries – GT to early TC
Strawberries – dormant to new growth appearing
Blueberries – bud swell to early GT
Brambles – dormant to early leaves
Grapes - dormant

Available frost/freeze protection options:

**Row covers**: Row covers are spun bonded polypropylene and vary in weight from 0.45 oz to 4 oz. Cloth sheets also work for small areas. 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. Be sure to anchor the row covers for the winds. If you have the swing arm trellis for blackberries, lower it to the ground and put the row cover back over it. A double layer where growth is already underway is advisable particularly for Tuesday night. 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.

**Straw**: Straw is a very good insulator which is one reason it is used for winter protection of strawberries. If you have removed the straw from your strawberry beds, put it back on. Adding a row cover on top is an added measure of security.

**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°F 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 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°F the buds will freeze; and limb breakage from heavy ice buildup.

Keep in mind, in a windy situation, you will not be able to maintain an even distribution of the water.

**Under-tree or surface watering**: As the water cools it releases heat into the environment around the trees and plants and also increases the relative humidity which reduces radiated heat loss. Advantage: the sprinklers do not need to be as precisely calibrated as they are for over-head sprinklers; if the system shuts down during the night the impact is not the same as with over-head watering.

Potential problems: saturated soils; increased root rot problems

**Wind machines**: This method carries an initial high expense but on sites that are frost prone this method will pay for itself. A temperature inversion and wind speeds less than 5 mph are required for this system to be effective. There are several models, mobile and stationary, tall for tree fruits and lower for
vegetables and small fruits. Acreage covered varies by model and the strength of the temperature inversion, generally 1 acre – 20 acres. May be used in combination with supplemental heat for large areas, or when the temperature is expected to be down to the low 20s, or with a weak temperature inversion.

**Helicopters:** The aircraft utilize the temperature inversion the same as the wind machine. Their mobility is an advantage which enables them to cover several small frost pockets or one large area as long they return to the starting point every 4-5 minutes. The larger the aircraft the more air it will move and the larger an area it will be able to cover. The larger aircraft will also be more expensive. These cannot be used in conjunction with any type of added heat that emits smoke for obvious safety reasons. Refer to the pilot for the types of lighting needed to mark the areas to be covered.

**Return Stack Heaters:** Heaters hold approximately five gallons of fuel with 20-40 heaters needed per acre, placing more on the upwind side of the block. They are effective when used alone as well as in combination with wind machines. 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.

**Open-Burning of Straw bales, Wood piles, etc:** 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. Small fires work best. Disadvantage of open burning – smoke. The smoke will hang over the field even after the sun is up but will not allow the heat from the sun’s rays to penetrate the smoke to warm the field keeping it colder longer. If the smoke is not there, it will have moved to your neighbor’s property – have fun dealing with that. Be sure to check with your local fire department in advance for a burn permit. Don’t bother with tires - you will never get a permit for them.

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