Perennia
Nova Scotia's Food Development Agency

SPRING FROST AND FREEZE DAMAGE

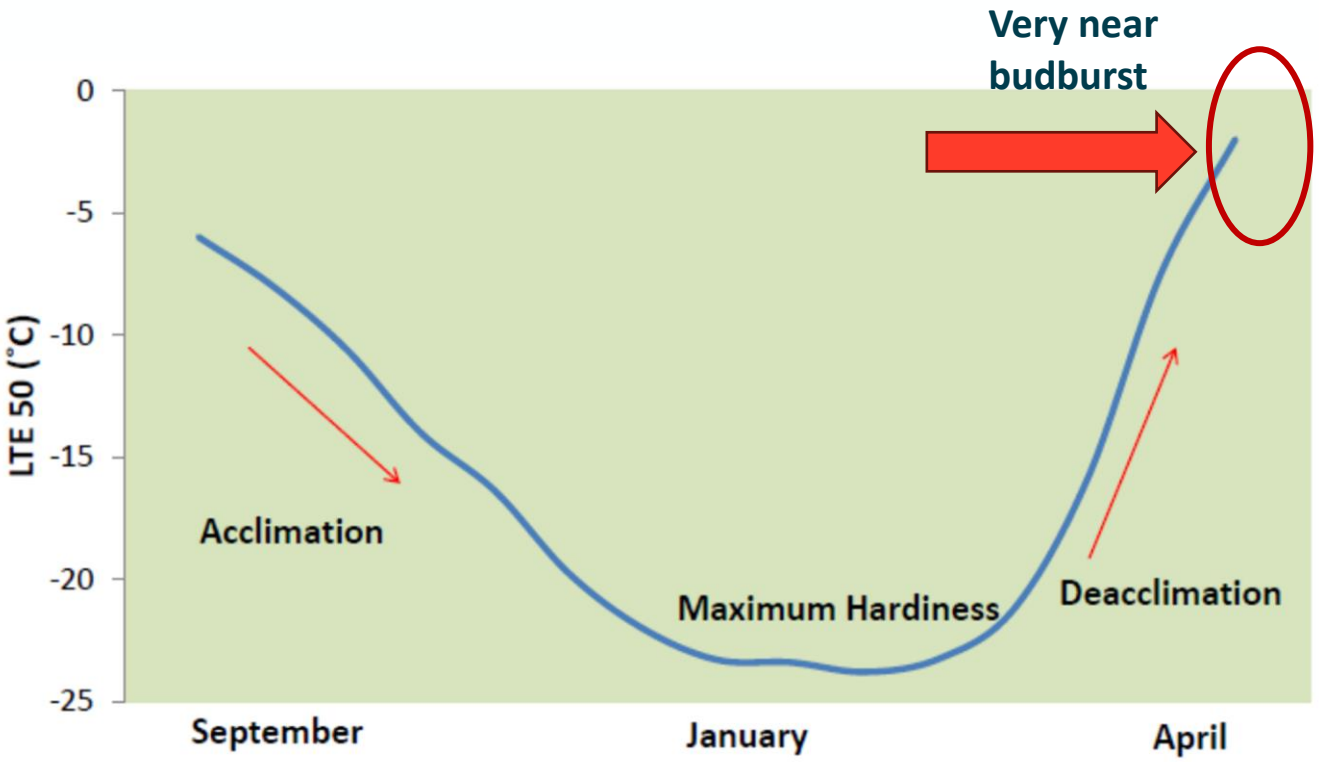
Prevention and Mitigation

13 May 2024

Table of Contents

- Where are we now?
- Frost vs Freeze? What is the difference?
- Types of Frost
- Passive Protection Methods
- Active Protection Methods
- What Makes a Good Protection Strategy?
- Key Points to Remember

Where Are We Now?



Osceola Muscat

Geisenheim

Critical Temperatures

Growth stage	Critical Temperatures
Dormant bud	Minus 5 C
Dormant swollen bud	Minus 3 C
Bud Burst	Minus 2 C
One leaf unfolded	Minus 1.5 C
Two or more leaves unfolded	Minus 1 to 0 C

The stage of grapevine phenology, or its position in the plant life cycle, influences frost damage susceptibility

Frost vs Freeze

FROST

- The occurrence of air temperature of 0°C or lower.
- Concerned about frost when vine is actively growing.

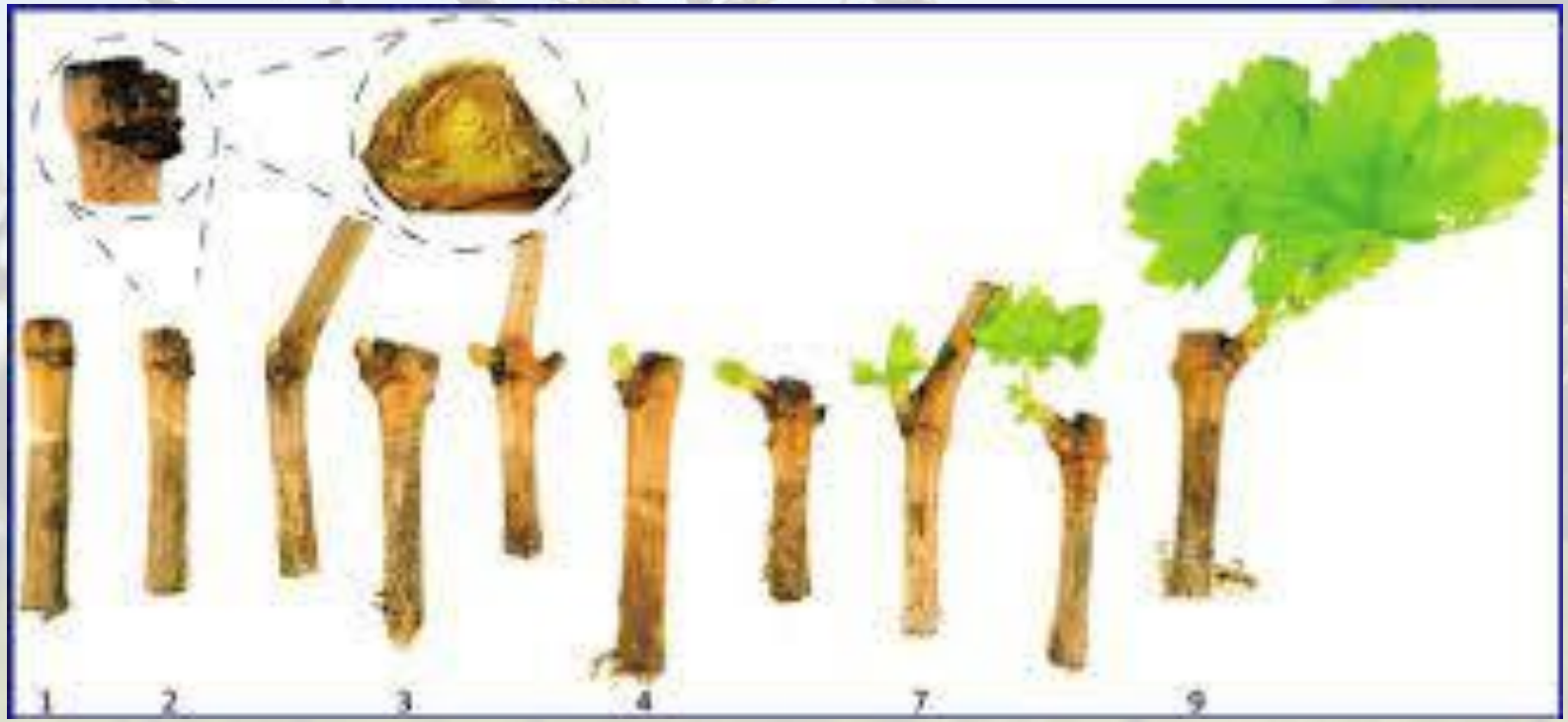
FREEZE

- Occurs when water within the plant tissue freezes

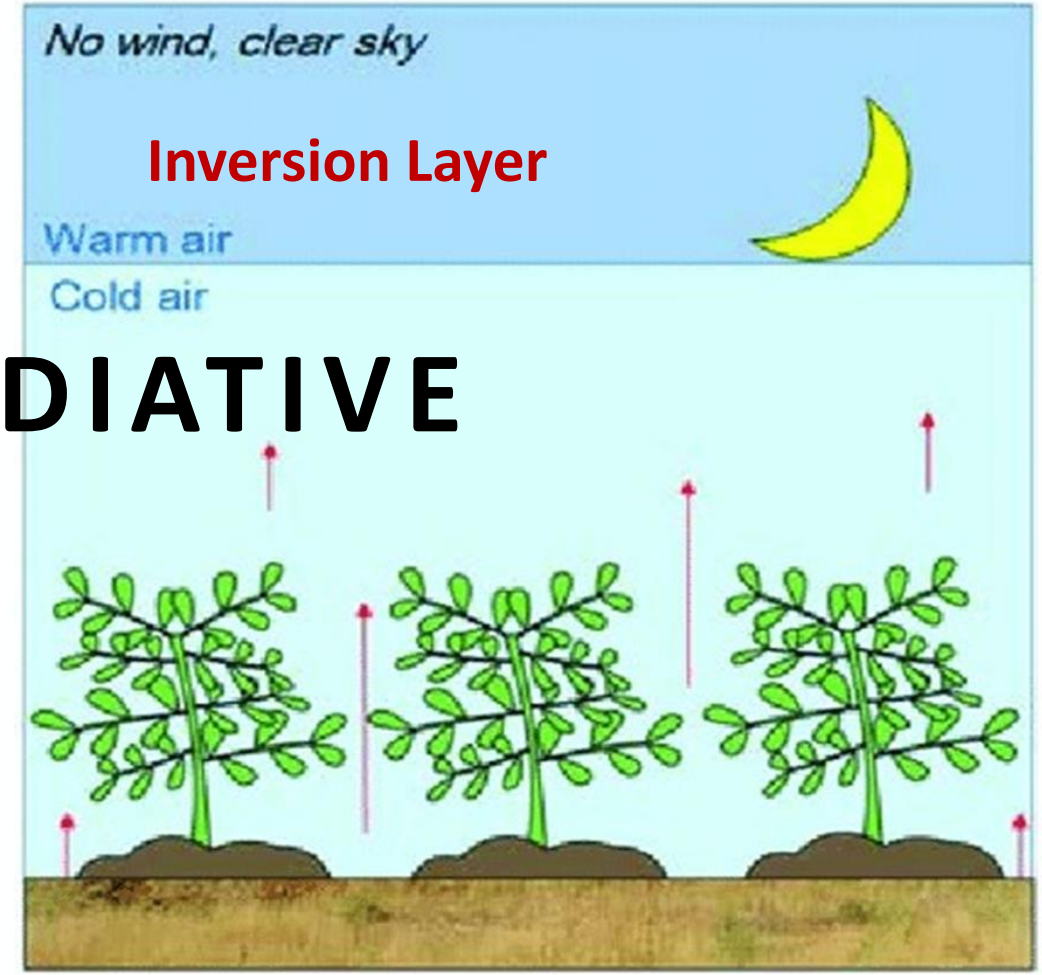
(winter freeze).
When vine is dormant.

Why Is Springtime Crucial?

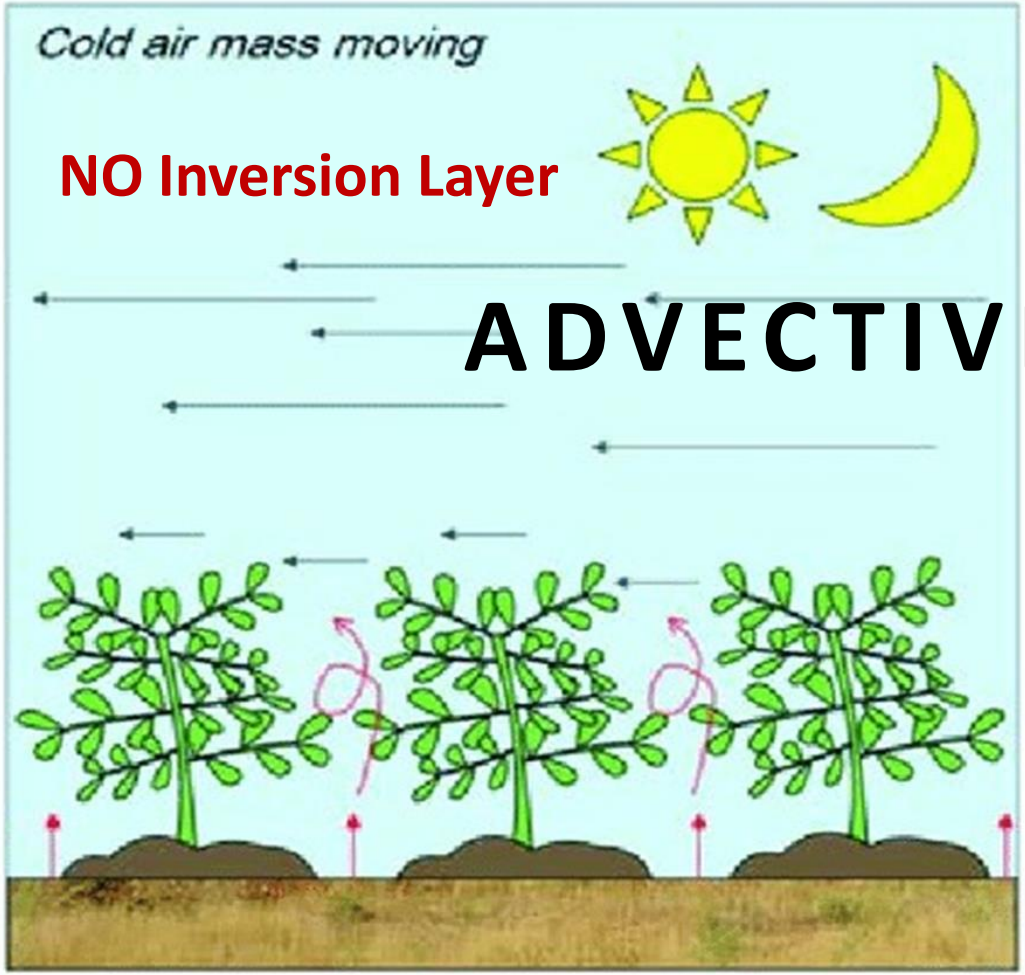
- Budburst
- Young Shoots
- Green Tips
- High Water Content
- Susceptible to Freezing



Two Types Of Frost



RADIATIVE



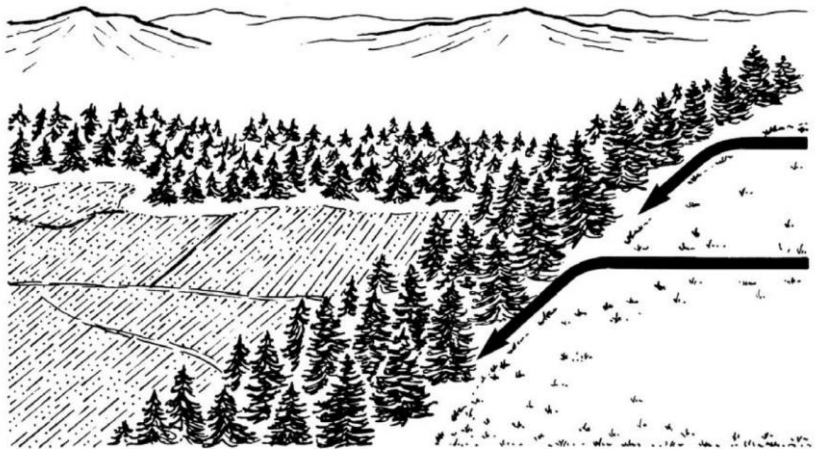
ADVECTIVE

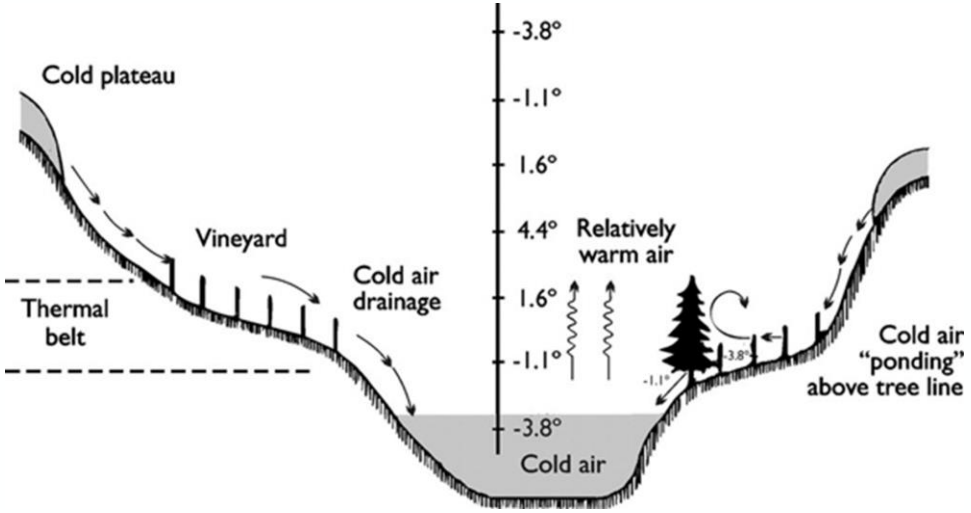
Passive Protection Strategies

- **PREVENTION**
- To decrease probability and severity of frosts/freezes.
- To make plant less susceptible to cold injury
- Can be implemented **before** and some implemented
- after vineyard establishment

Strategies Prior to Planting

Site Selection/Vineyard Design



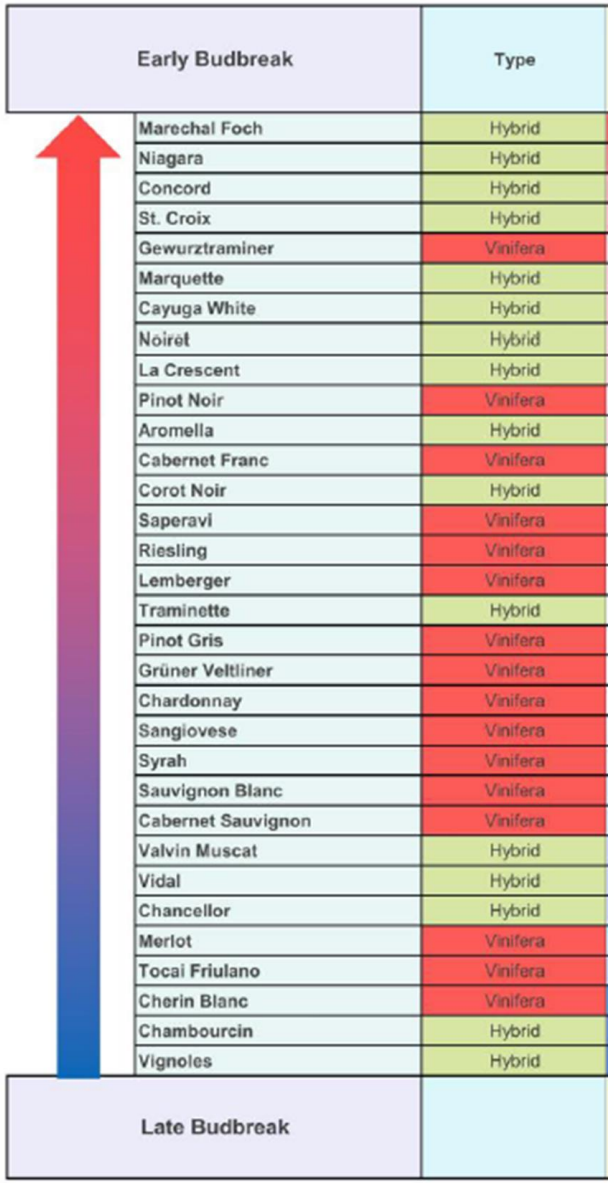


- Minimize blockages- no physical barriers to cold air flow.
- Plant on slopes where possible.
- Plant cultivars suited to the site and weather conditions.
- Proximity to water.

Cultivar Selection

Hybrid vs vinifera

- Cold hardiness (budbreak early on most winter hardy cultivars)
- Early vs late bud break
- Bud fruitfulness- secondaries may be fruitful if primaries are damaged (hybrids)



Middle Row Management

DOs

SHORT INTER-ROW COVER CROPS

- 5cm and under

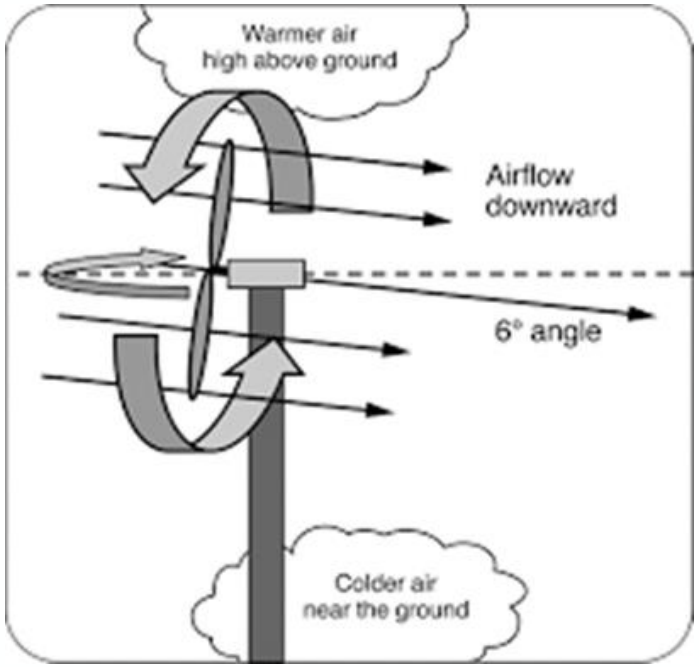
DON'Ts

- UNMANAGED COVER CROPS
- COMPLETELY BARE SOIL.

Active Protection Strategies

What is it? Methods applied just before and or during the frost event to prevent tissue damage, by either preventing the loss of heat or by providing additional protection to growing tissue.

- Modify the climate within the vineyard
- Prevent frost/tissue damage.
- Work to conserve heat or mix with cold air mass.
- Multiple measures may be necessary.
- **Considerations:** degree of protection required,
- Size of area to be protected
- Cost of equipment, installation, operation (hrly cost of fuel).



Remember: There is no perfect method of frost protection-especially if winds are 5km/h or more.

Wind Machines

HOW IT WORKS:

Mixes inversion layer (warm air) with the cold air trapped underneath it.

PROS:

Works well for radiative frosts.

CONS:

- **Not suitable for Advective Frosts**

(moving cold air masses)

- May not be suitable for smaller vineyard plots or those planted on significant slopes.
- Costly to install, operate
- Noisy- Usually run at night
- Do not operate in windy conditions

(10 km/h or greater wind speeds)

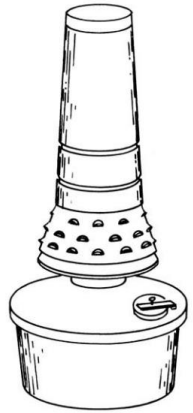
Growth stage	Critical Temperatures	Suggested temperatures for start-up of wind machines
Dormant bud	Minus 5 C	Minus 2 to Minus 3C
Dormant swollen bud	Minus 3 C	Minus 1 to 0 C
Bud Burst	Minus 2 C	0 C to Plus 1 C
One leaf unfolded	Minus 1.5 C	Plus 1 C to Plus 2 C
Two or more leaves unfolded	Minus 1 to 0 C	Plus 1 C to Plus 2 C

Supplemental Heat Sources

HOW IT WORKS:

- **Air must be still for best results.**

Provide frost protection by heating the air as uniformly as possible up to the inversion layer. As the heated air rises, it cools until it reaches the height where the ambient air has the same temperature of the inversion layer. Air circulates and warms.



Possible Benefit- Likely?

- With an inversion layer present, heat is trapped and recycled back to the ground.

Potential Negative Impact

- Air pollution.
- Wildfire risk.
- If the ground source of heat (example: bonfires or large burning areas), excess heat can puncture inversion layer and eliminate effectiveness.
- **EXTREMELY COSTLY IN MATERIAL AND LABOUR TO SAFELY ATTEMPT**

Is it Efficient/Cost Effective?

- Managing ground cover
- Use of supplemental controls
    - Wind machines
    - Helicopters
    - Supplemental heat source
    - Over-row irrigation
    - Chemical Applications

Are they applicable in Maritime conditions?

What Makes a Good Frost Protection Strategy?

Must be economically sound.

- Consider crop potential loss, expenses, management practices, lost production, vine damage, market share, etc…
- Initial planning can save time and $$$ later.
- What can be implemented today?

What can I do NOW to plan for the future?

Questions?

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Key Takeaways: (Before and After Planting)

- BE AWARE OF VINEYARD SITE LIMITATIONS

- PICK THE RIGHT SPOT TO PLANT EACH CULTIVAR

-THE GROWTH CYCLE OF EACH CULTIVAR AT YOUR LOCATION-

- IS MY SITE SUITABLE FOR SUPPLEMENTAL PROTECTION? Can I afford it?

- HOW CAN I BE SURE TO GROW THE HEALTHIEST VINES POSSIBLE?

- GOOD VINE MATURITY IS GOOD VINE HEALTH (vine going into winter conditions in best possible health)

Thank You

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Chemical Applications

- Vegetable-based oils
- Can delay bud break 2-20 days (super variable)
- KDL (Agro K); potassium dextrolac (no response)
- Must be applied at least 36 hours before a frost event
- Repeat application 36 hours after
- Vapor Gard (Miller); terpene-polymer- trying to reduce transpiration. Delays growth to prevent damage.
- Forms microscopic film over the leaf and plant surface that reduces the loss of water vapor; improves cold tolerance
- Copper (Badge, etc.) doesn't work.
- Sprays to eliminate "ice nucleating" bacteria have shown limited efficacy (spotty data; doesn't work on grapes)