Grapevine Crop Load and Canopy Management for Cool Climates

ANDREJ SVYANTEK, ZHUOYU WANG, ZACH MILLER

Grapevine Crop Load and Canopy Management for Cool Climates: Damned If I Do, Damned If I Don't.

ANDREJ SVYANTEK, ZHUOYU WANG, ZACH MILLER

My Background

When last we met….

Altering Grapevine **Crop-Load** and Canopy Architecture through **Cultural** and Genetic Methods

Altering Grapevine Crop-Load and **Canopy Architecture** through **Cultural** and Genetic Methods

Altering Grapevine Crop-Load and **Canopy Architecture** through Cultural and **Genetic Methods**

Cold Damage North Dakota

- **2018-2019 Winter**
  - Eliminated Need for Work on Cropload and Canopy Management in 2020 for most cultivars.
- **Planned Work on:**
- Alpenglow, Baltica, Bluebell, Brianna, Crimson Pearl, Edelweiss, Frontenac, Frontenac gris, Kay Gray, King of the North, La Crescent, Laura's Laughter, Louise Swenson, Marquette, Petite Pearl, Prairie Star, Sabrevois, St. Croix, Somerset Seedless, Verona, Valiant

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DEAD

INJURED

NEARLY UNSCATHED

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Cold Damage North Dakota

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- **SURVIVORS**
- King of the North
- Valiant

DEAD

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Marquette

Develop Techniques for Cold-Hardiness Research in Perennial Fruit Crops

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Cold Hardiness

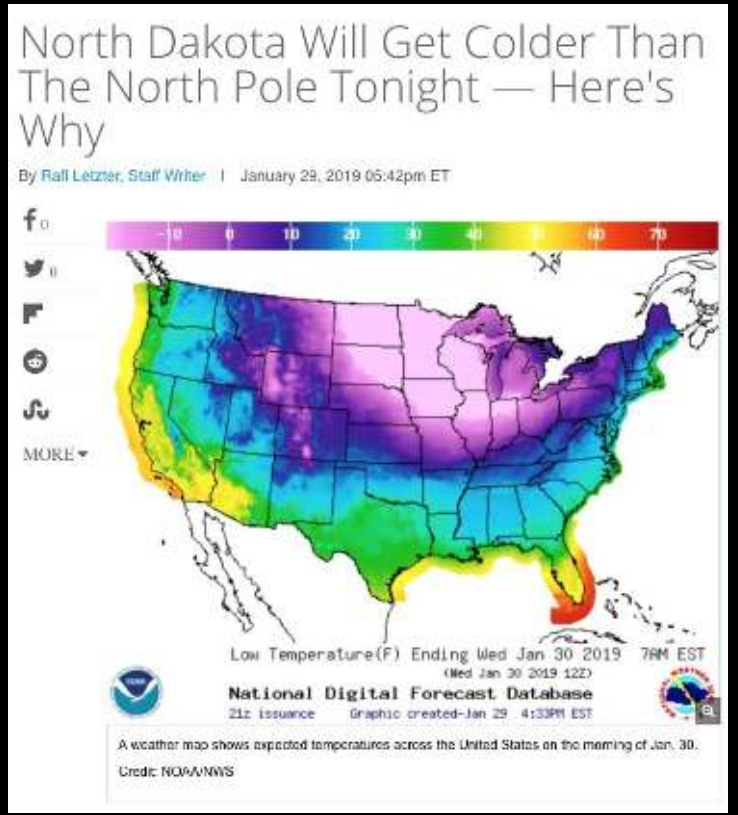
North Dakota

North Dakota

NDSU Grape Germplasm Enhancement Project

Increasing Cold-Hardiness and Environmental Durability

- Mid-winter, absolute cold-hardiness
- Fall acclimation



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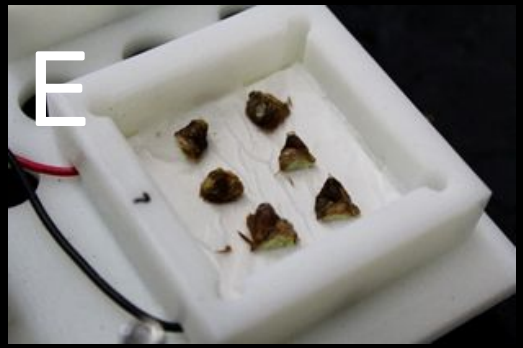
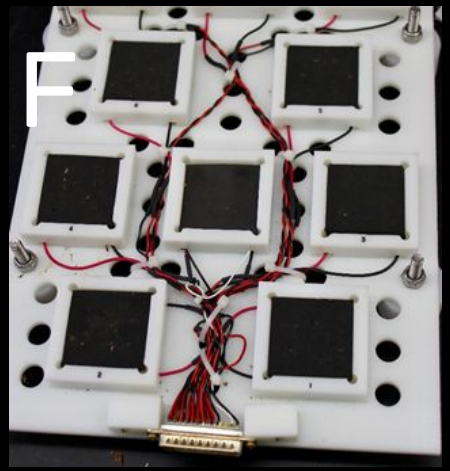
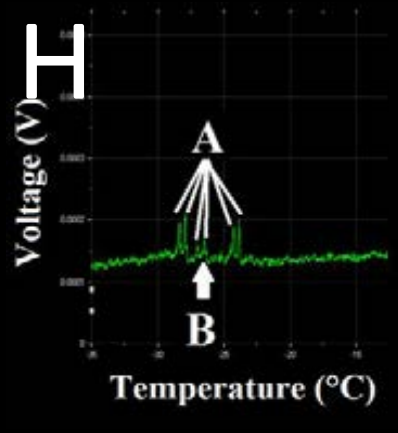
Cold-Hardiness Measurements

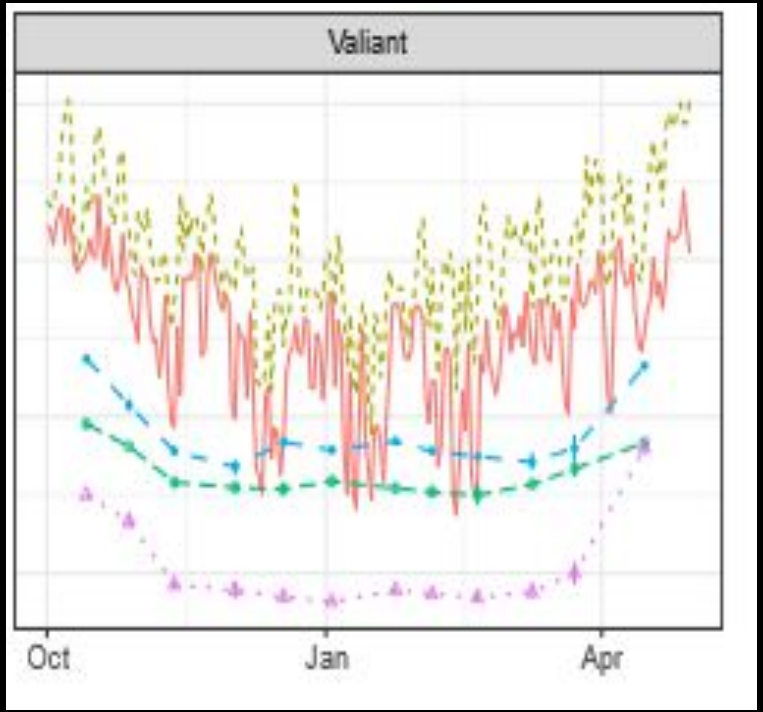






Develop Techniques for Cold-Hardiness Research in Perennial Fruit Crops

- How Cold-Hardiness Evolves Throughout the Dormant Season for Different Species/ Cultivars/ Tissue Types



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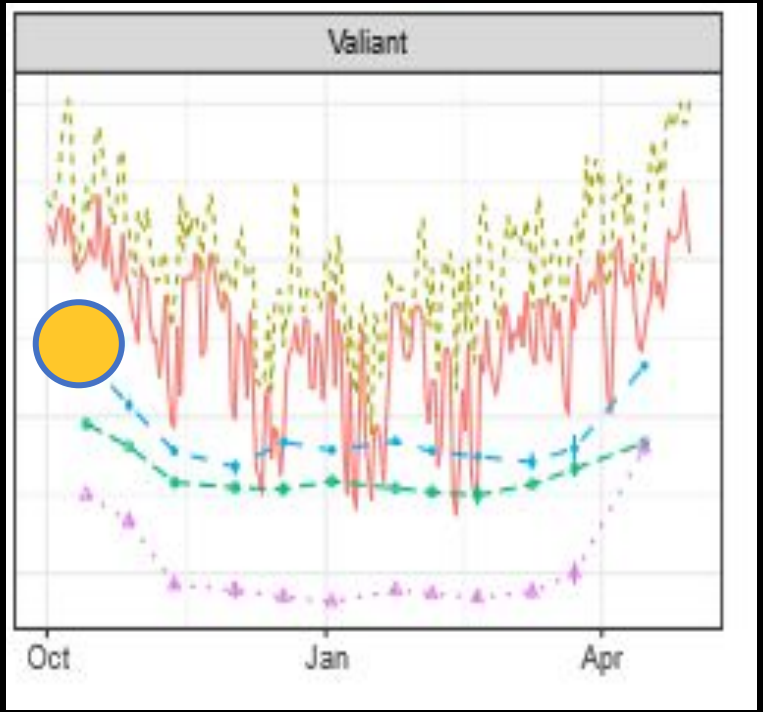

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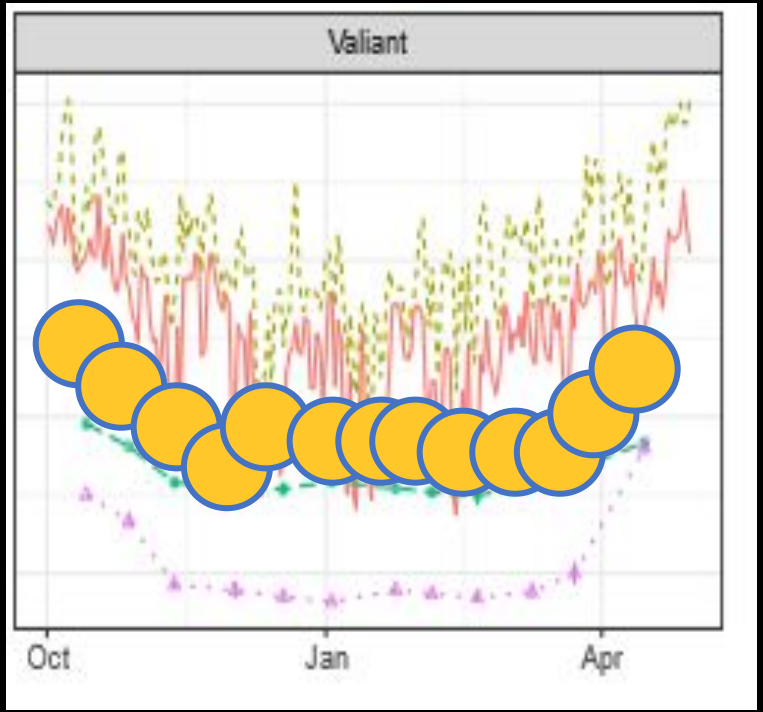
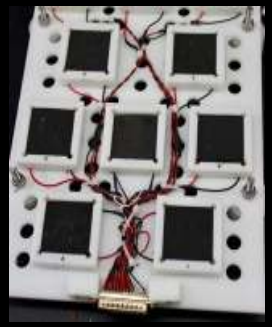
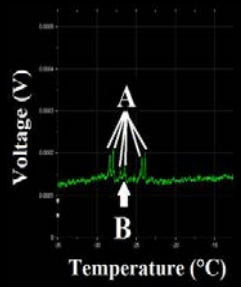


Develop Techniques for Cold-Hardiness Research in Perennial Fruit Crops

- Simulate Cold Acclimation of Plants Under Controlled Conditions





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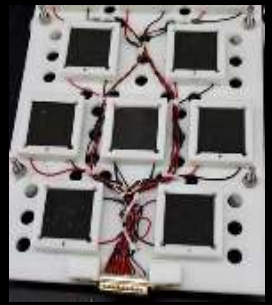
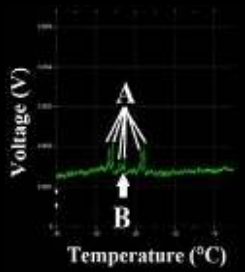




Develop Techniques for Cold-Hardiness Research in Perennial Fruit Crops

- Stimulate Cold-Hardiness, Accelerate Hardening Off, Improve Winter Survival

Develop Techniques for Cold-Hardiness Research in Perennial Fruit Crops

Critical Question for MT following October 2020 freeze event.

Montana is Not North Dakota

Montana is Not Alabama

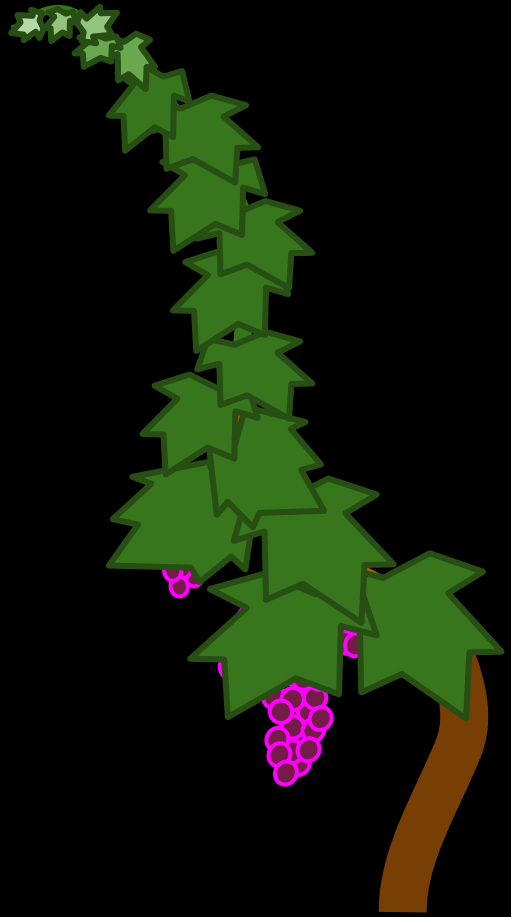
Montana is

I Want to Give You A Silver Bullet

I Want to Give You A Silver Bullet/ I Can’t

What Can Leaf Removal Do For You?

- Improve Sunlight and Air Penetration



Grapevine cartoon.

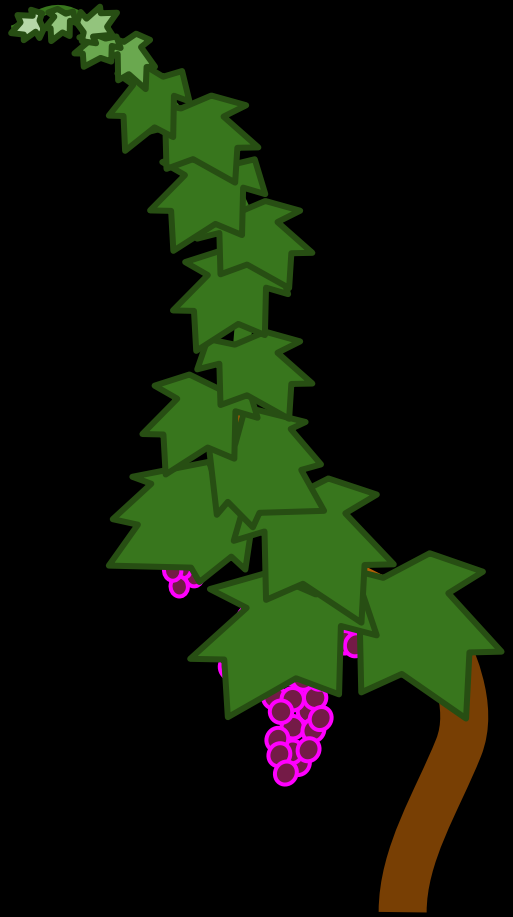
What Can Leaf Removal Do For You?

- Improve Sunlight and Air Penetration

Rotting and clean southern wine grapes, Sand Mountain Research Extension Center, 2015-2016.

What Can Leaf Removal Do For You?

- **Improve Sunlight and Air Penetration**
- Improve Pesticide Spray Penetration
- Increase Flavor Compounds
- Increase Aromatic Compounds
- Increase Color Compounds
- Reduce Titratable Acidity
- Reduce Herbaceous Compounds
- Increase Bud Fertility



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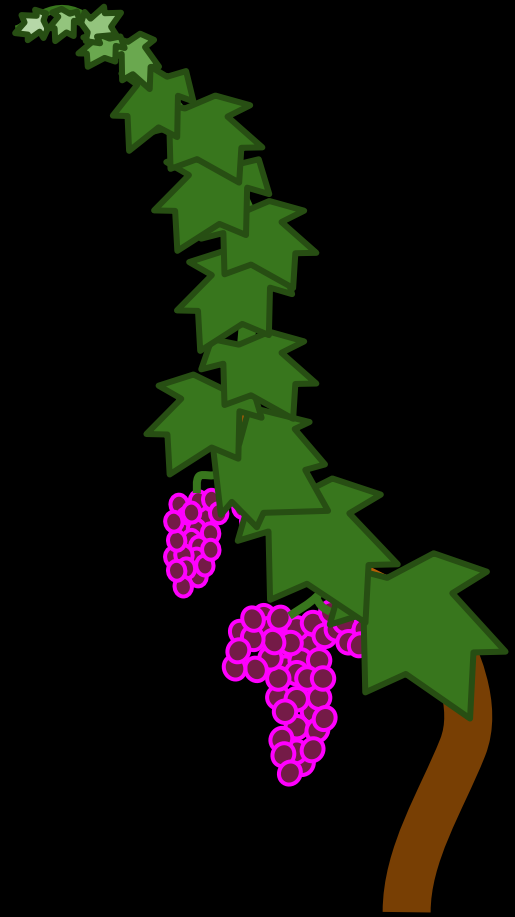

Grapevine cartoon, now with less disease.

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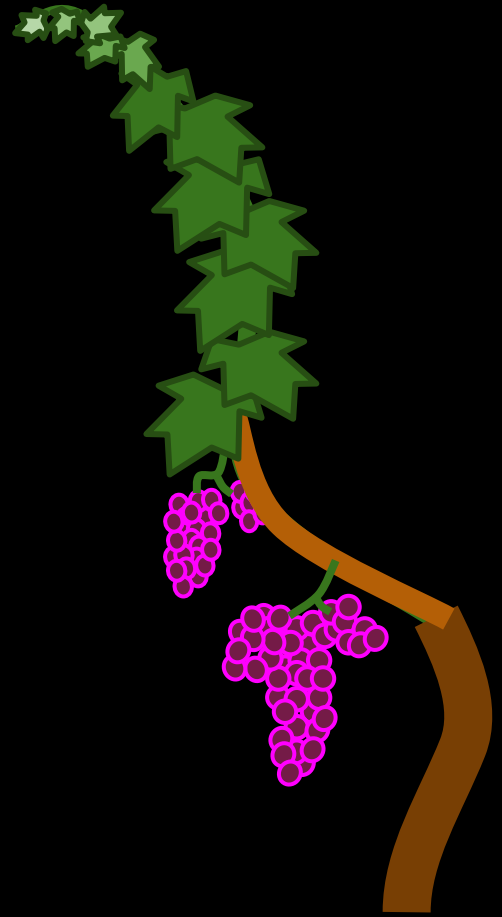

Grapevine cartoon, now with less disease, more flavor.

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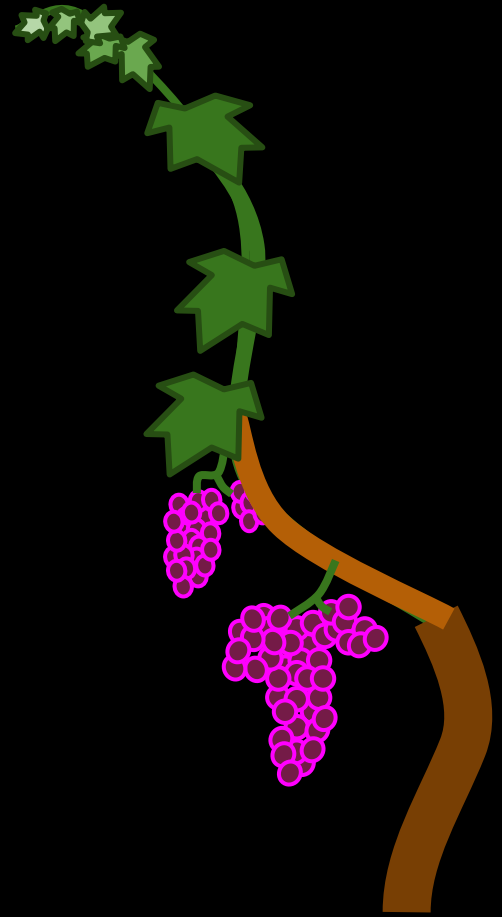

Grapevine cartoon, now with less disease, more flavor, less acid.

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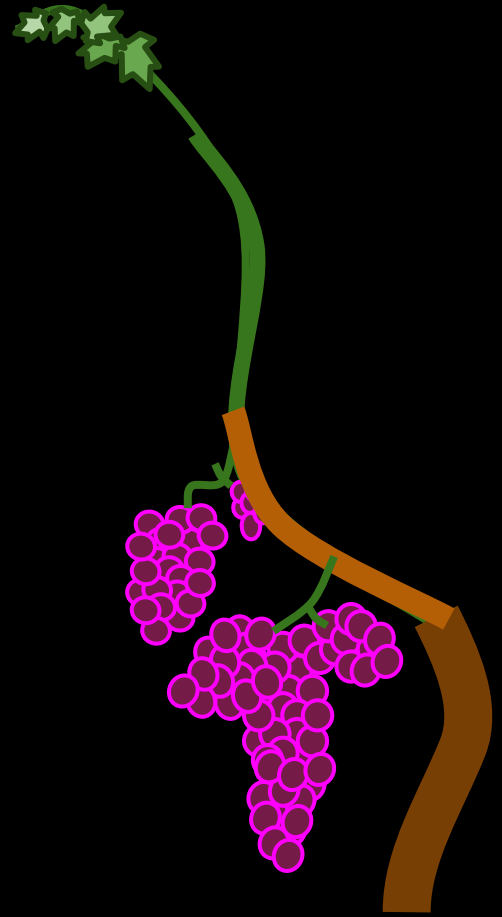


Grapevine cartoon, now with less disease, more flavor, less acid, and more fertility.

BREEDING FOR LABOR REDUCTIONS

PRUNING

- **Pruning Time**
  - Many Cold-Hardy CV
- **Pruning Type**
  - Prairie Star
- **Pruning Severity**
  - Prairie Star

CANOPY

- **Shoot Positioning**
  - Frontenac gris
  - Prairie Star
- **Fruit Zone Leaf Removal**
  - Marquette
  - Sabrevois

CROP LOAD

- **Cluster Thinning**
  - Sabrevois
- **Shoot Thinning**
  - Frontenac
  - Frontenac gris
- **Yield Levels**
  - Frontenac
  - Frontenac gris
  - Prairie Star

Fruit Ripening

Frontenac

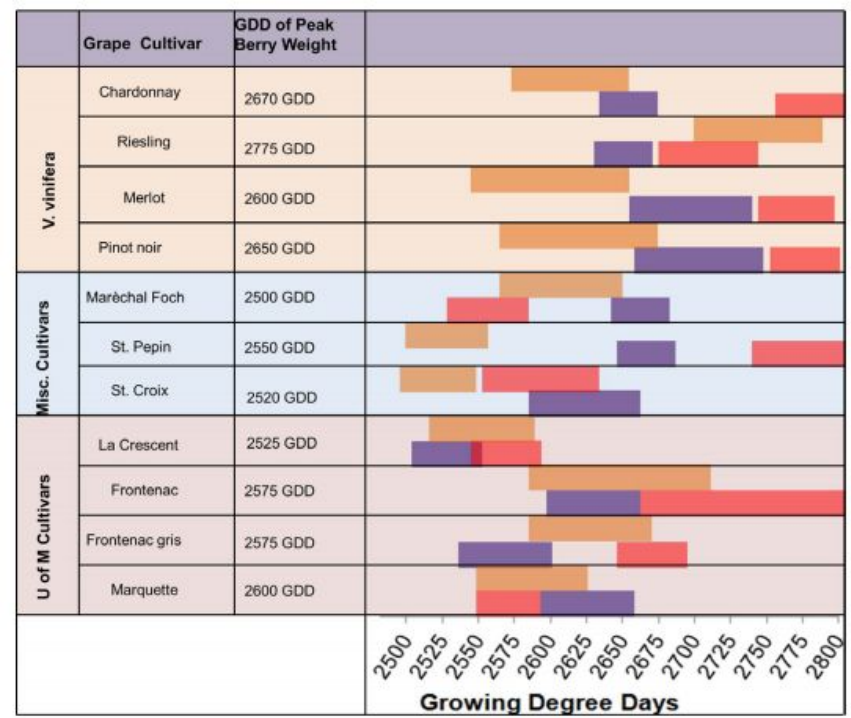
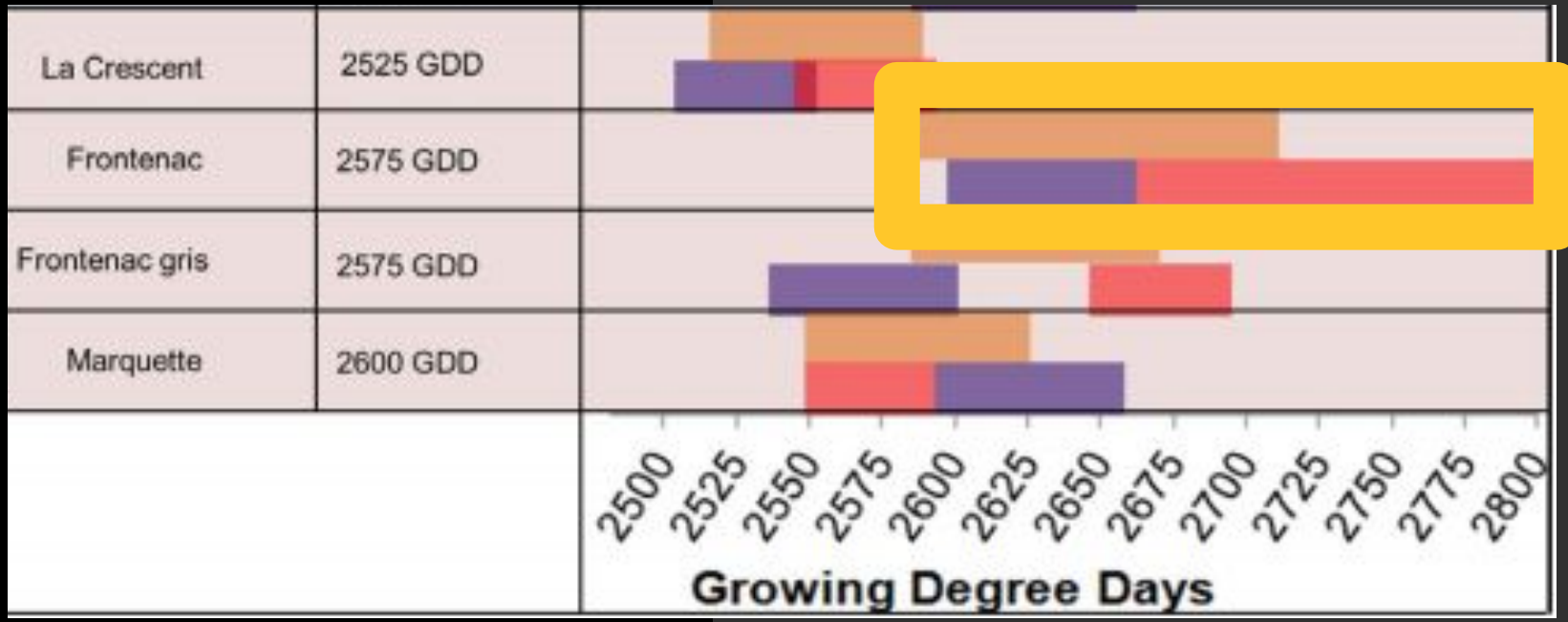


Table 1. Colored boxes indicate when there is no longer a significant change in °Brix, pH, and TA in respect to GDD, highlighting the range of peak maturity for each trait in grapes grown in Chaska, MN. Peak weight is the maximum weight achieved during the harvest season.

Haggerty, 2014



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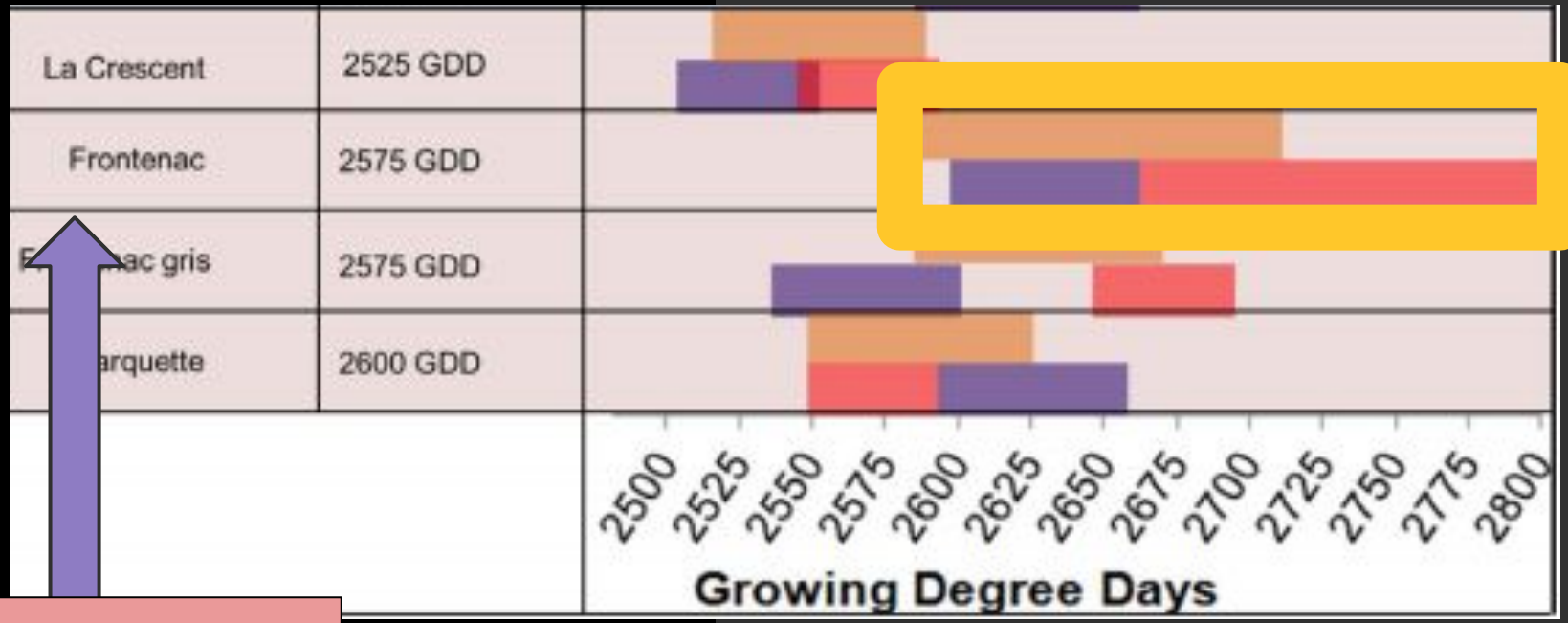
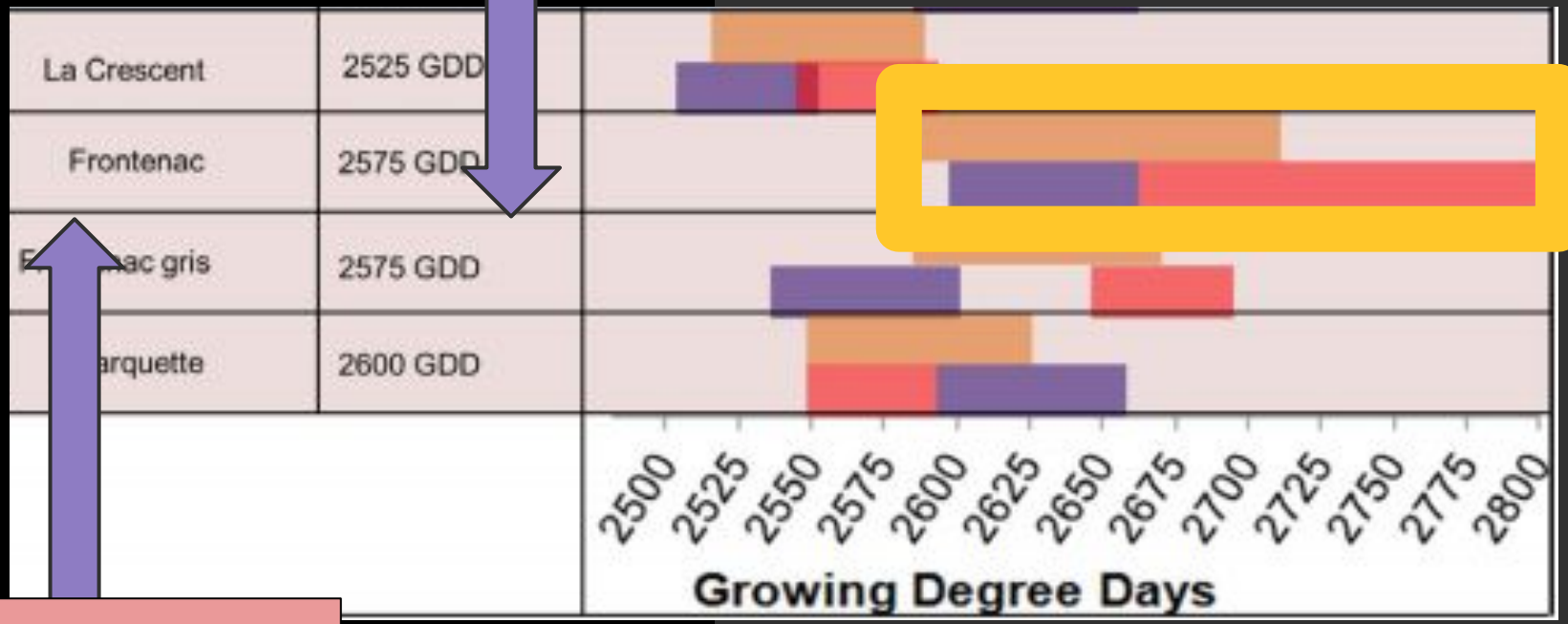


2309 GDD, 2017

Haggerty, 2014

2448 GDD, 2018



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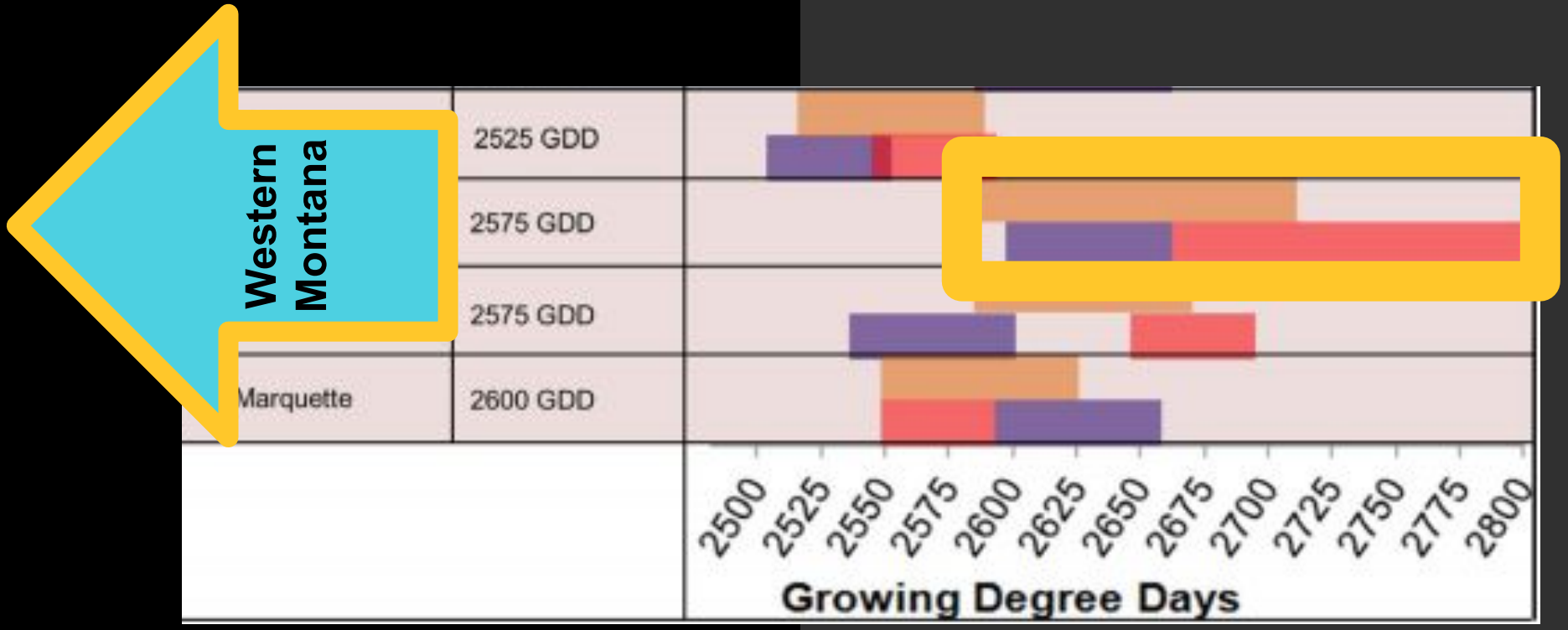


Haggerty, 2014

Canopy Management Work in Montana

- **Row Cover Vs. Summer Pruning Vs. Untreated**
- **Early Leaf Removal Vs. Late Leaf Removal Vs. No Leaf Removal**

Canopy Management to Speed-up Maturity

WARC vineyard 2019

- 6 varieties
  - REDS: Marquette, Frontenac, Petite Pearl
  - WHITES: La Crescent, St. Croix, Front gris
- 3 Treatments:
- Control: almost no summer pruning
- Summer Pruned: shoots cut back to ~4-6 leaves after fruit set
- Row-Cover: covered with Agribon-19 fabric to trap heat
- Yields 8-12 lbs. vine

Canopy Management to Speed-up Maturity

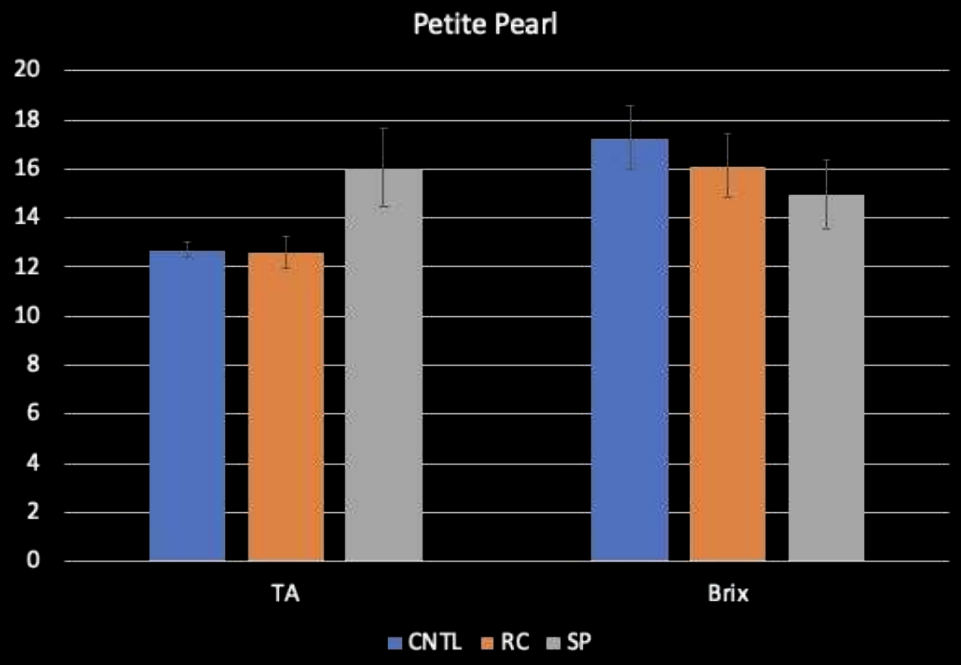
- Row cover did not increase heat or speed up ripening
- Effects of summer pruning varied among varieties

REDS-

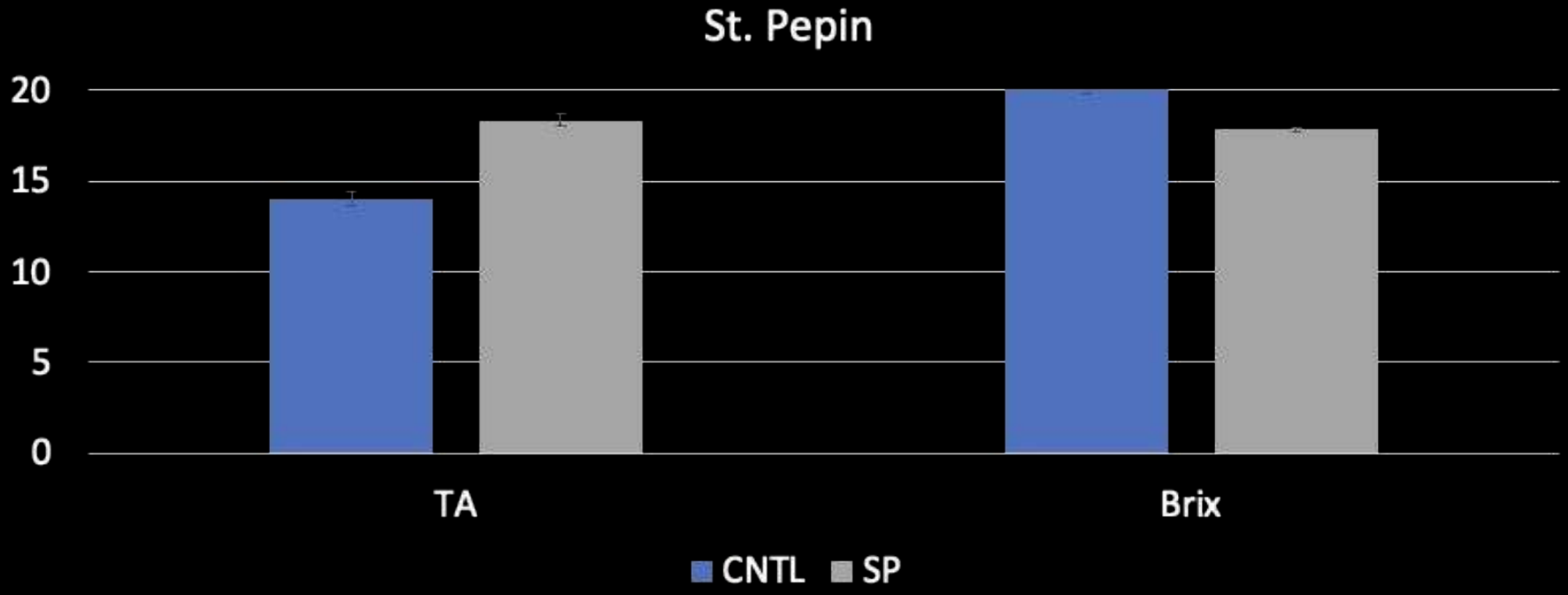
- TA and brix not affected by pruning in Frontenac and Marquette
- Pruning slowed Petite Pearl

WHITES:

- Frontenac gris and LaCrescent not affected by pruning
- Pruning slowed ripening in St. Pepin



Summer Pruning did not Speed-up Ripening; it Slowed Ripening in some Varieties.



Petite Pearl- Summer Pruned

Petite Pearl- Control

Somerset Seedless
Summer Pruned

Somerset Seedless
Control

Somerset Seedless
Summer Pruned

22° Brix

Somerset Seedless
Control

25° Brix

WARC 2020 Fruit Zone Leaf/Lateral Removal (FZLR)

- No effect of FZLR in 7 of 8 varieties
- LLP decrease brix in La Crescent
- No effects on TA

Brix

VAR	LLP	ELP	BMC
Front Gris	27.4a	25.9b	26.3ab
La Crescent	21.8d	22.8cd	23.3c
St. Pepin	22.3cd	23.5c	23.3c

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- LLP decreased pH (slowed ripening) in St. Pepin
- ELP may increase pH in Somerset

pH

VAR	LLP	ELP	BMC
Front Gris	3.19de	3.13f	3.16ef
La Crescent	3.31a	3.29ab	3.31a
St. Pepin	3.24cd	3.25bc	3.28ab

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FZLR Effects on Red Juice and Wine Quality

Fruit zone leaf removal affected Total Phenolic compounds (TPC), but not tannins or anthocyanins.

JUICE:

- Frontenac: ELP and LLP increased TPC by 8% from 1283 in controls to 1389 mg/L
- Marquette: FZLR did not affect juice TPC. ELP tended to be greater than BMC but lots of variation among vines.

WINE:

- ELP increased TPC by 9% compared to controls.
- Late leaf pull similar to ELP and Controls
- Effects similar between Frontenac and Marquette

FZLR Effects on Red Juice and Wine Quality

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RECOMMENDATIONS FOR MONTANA

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- **Up to Us (everyone in this room) to Determine.**

HELP US ESTABLISH A MANAGEMENT PLAN

- **Canopy and Crop Management: On-Farm Research**

Data: A Guide To a Happy Harvest

Pruning Weight	Flowering Date	Cluster Weight
Cane Number	Weather at Bloom	Yield
Average Cane Diameter + Length	10 % Berry Color	Brix
Bud Number Retained	50 % Berry Color	pH
Pruning Date	100 % Berry Color	TA
Bud Burst Date	Harvest Date	Leaf Fall
Last Frost Date		First/Killing Frost Dates