

Fruit Production: Business Planning, Variety Selection, and Crop/Pest Management

Dr. Zach Miller-Assistant Professor & Director at MSU-Western Ag. Research Center, Dr. Rachel Leisso, Dr. Mac Burgess, Dr. Heather Estrada, Katrina Mendrey, Amy Hutton, Kyrstan Hubbel, Bridgid Jarrett, Durc Setzer

JAN, 2020



Outline

- Western Agricultural Research Center (WARC)
 - Viticulture program update
 - Weed management review
 - Berry program update



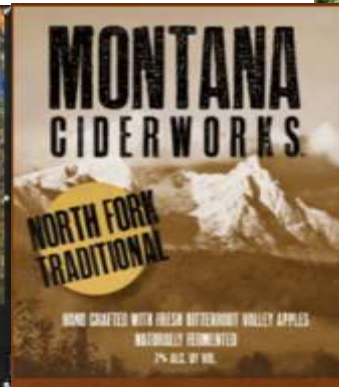
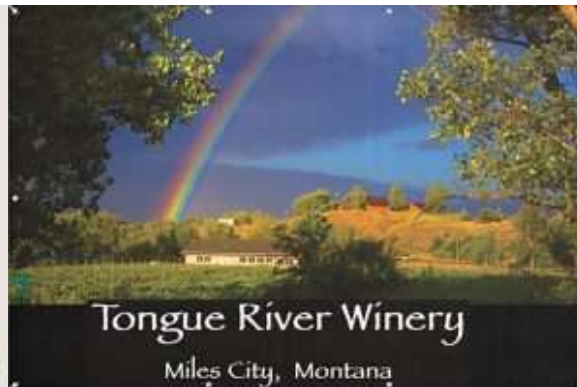
Growing Demand: Local Food (and Drinks)



- Supporting local-grown and sustainable practices
- Interest in eating healthy
- #2 in microbreweries per capita



TASTING ROOM OPEN NOW!



Marketing/Market Access

- **Business-Marketing** as important than what/how you grow
- Access to markets/consumers is your responsibility
 - Diversify: identify multiple markets/buyers
 - Explore value-added processing
 - Learn from peers/leaders



High Start-up Costs-Protect your investment

- >\$10,000/ac
- Fencing: \$2,500
- Bird Protection: \$1,800-3,500
- Weed Control, Irrigation, Etc.: \$1,000
- Plants: \$4,000+
- Trellis: \$1,500-2,500
- Does not include labor (2-3x), harvest/processing machinery, marketing, etc.
- **Slow Return**



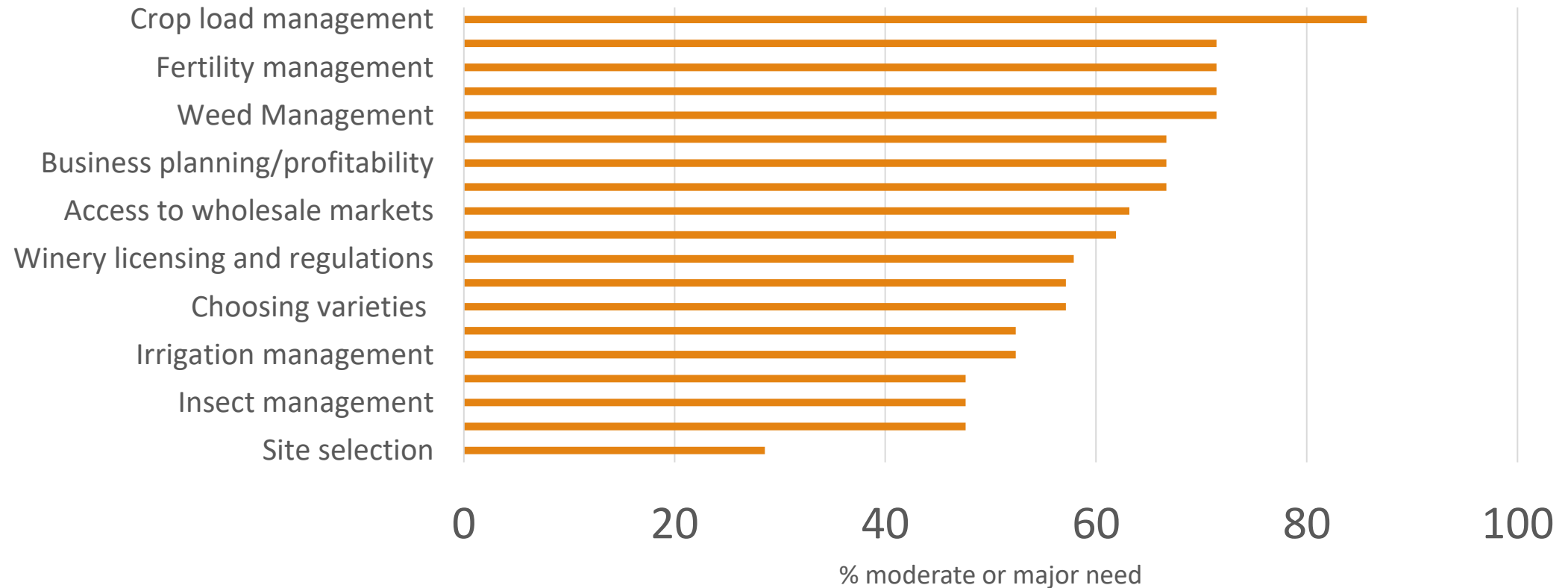
Improving yields and quality of wine grapes and wine.

Optimizing plant nutrition and crop loads for grape quality and yield

Improving management practices for cold-hardy, hybrid grapes

Deliver needed research/education for MT vineyards and wineries

Assess needs and current practices

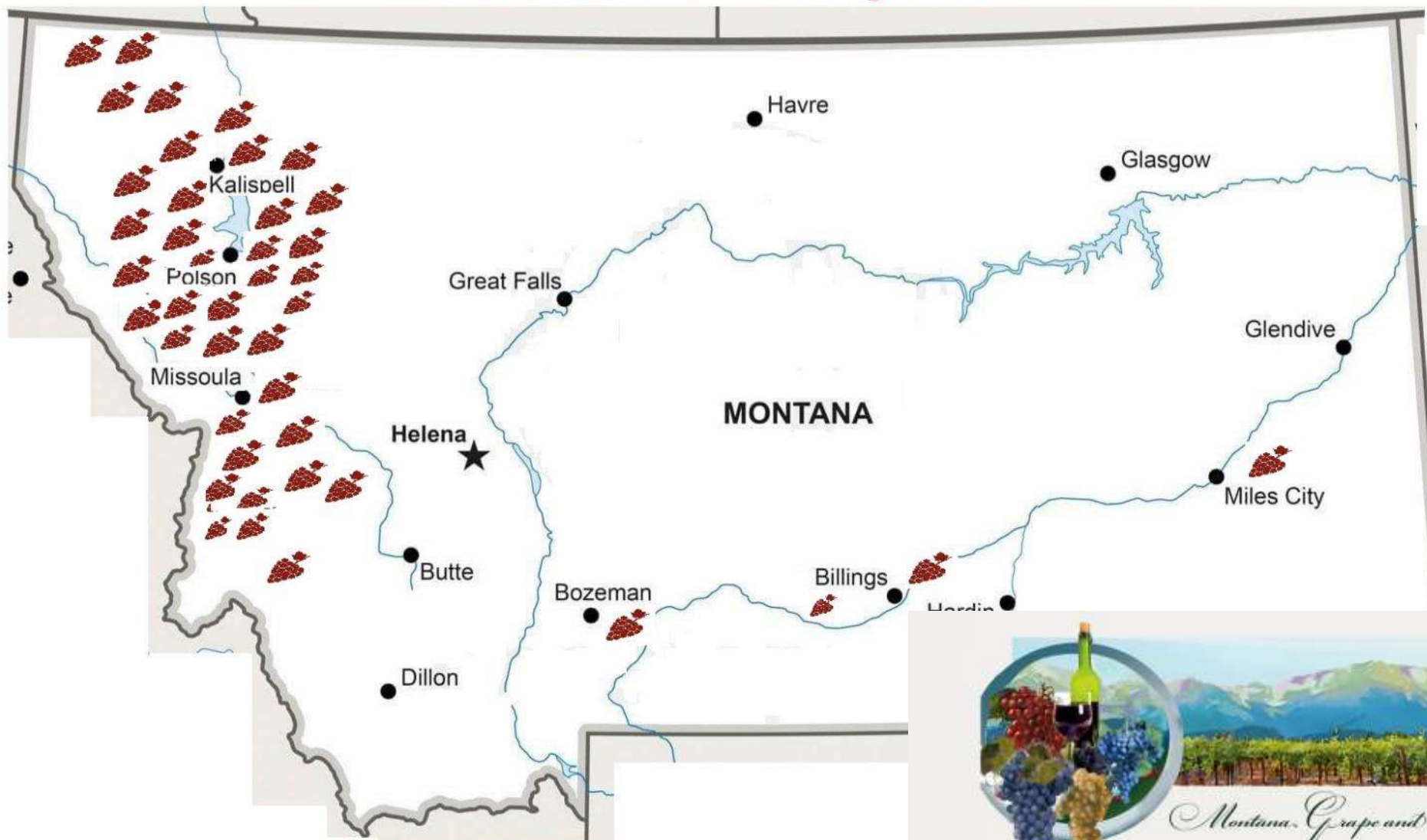


Adapted varieties

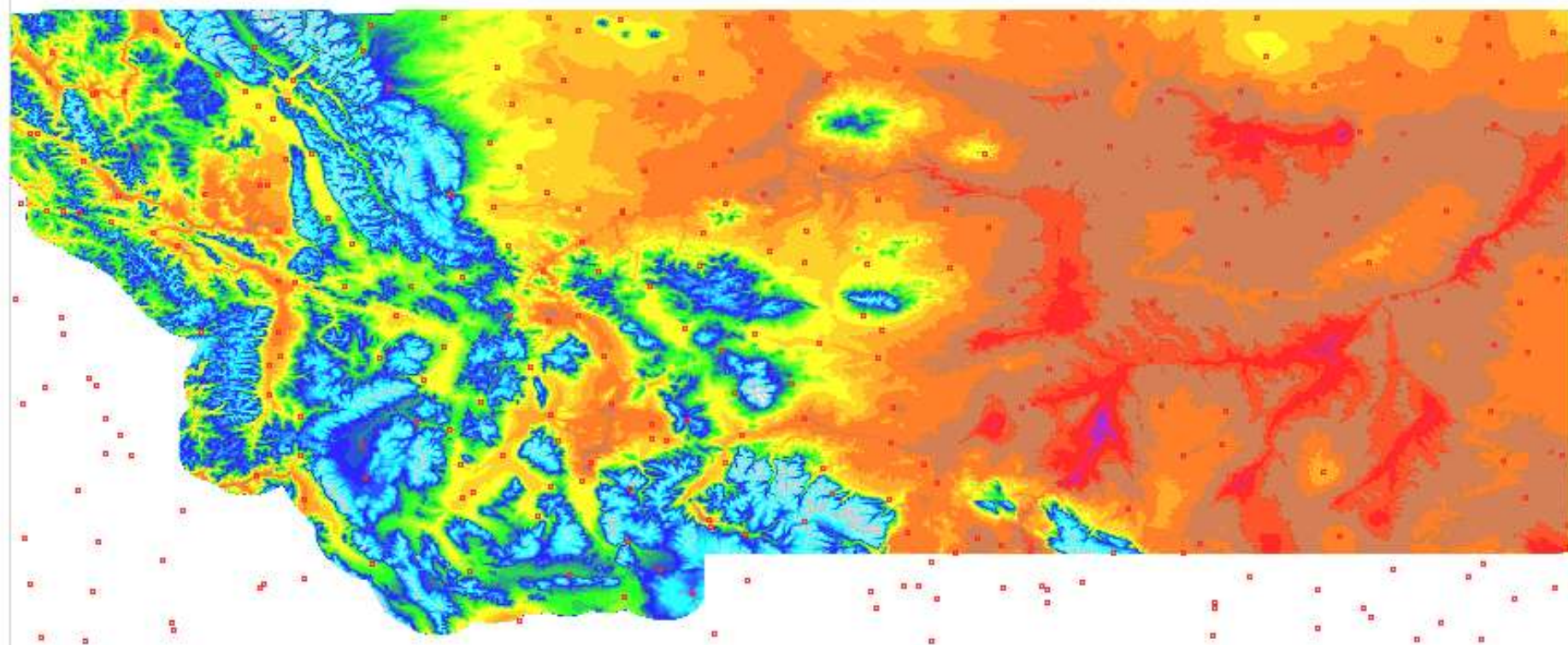
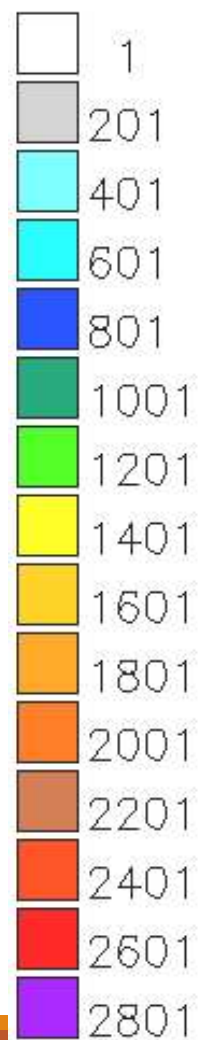
- Many new and old options
 - Often untested or being tested
- Winter temperatures
- Growing season length/heat
- Frost during bloom
- Neutral-Alkaline soils
- Also must match available labor and markets
- Location, location, location- must match fruit type to local climate and other factors.



Montana Vineyards

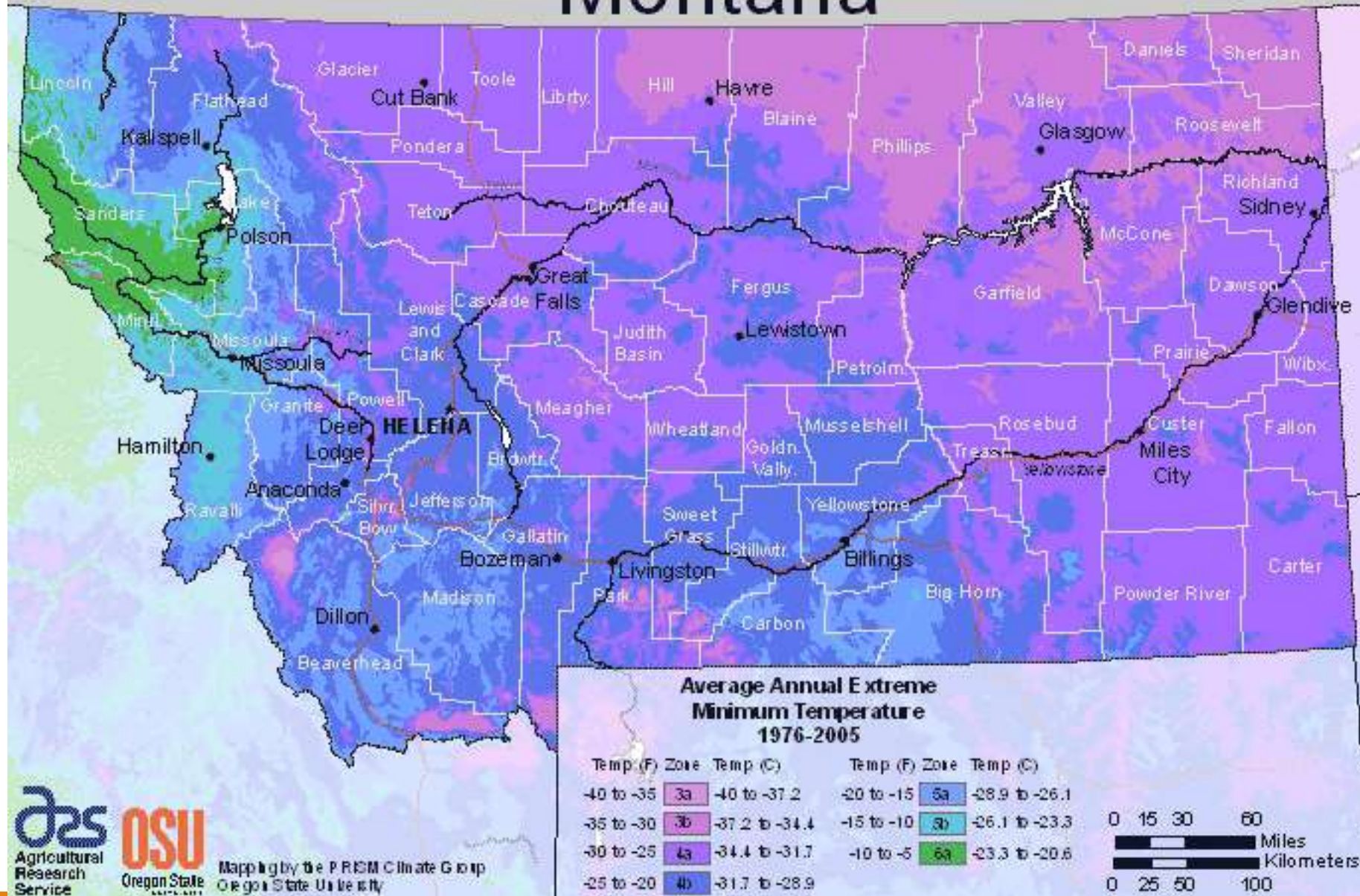


Degree-days
since Jan 1
(50 F threshold)



Cumulative degree-days in Montana Jan 1 – Dec 23 NORMALS

USDA Plant Hardiness Zone Map
Montana



Adapted varieties

- Many new and old options
 - Often untested or being tested
- Winter temperatures
- Growing season length/heat
- Frost during bloom
- Neutral-Alkaline soils
- Disease/pest resistance
- Suitable for markets, labor (mechanical harvest), flavor/quality, shelf-life/storage, processing
- **Picking the right varieties critical for managing risk**



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
 - Pruned: shoots cut back to ~4 leaves after fruit set
 - Row-Cover: covered with Agribon-19 fabric to trap heat
 - Yields 8-12 lbs. vine



Somerset

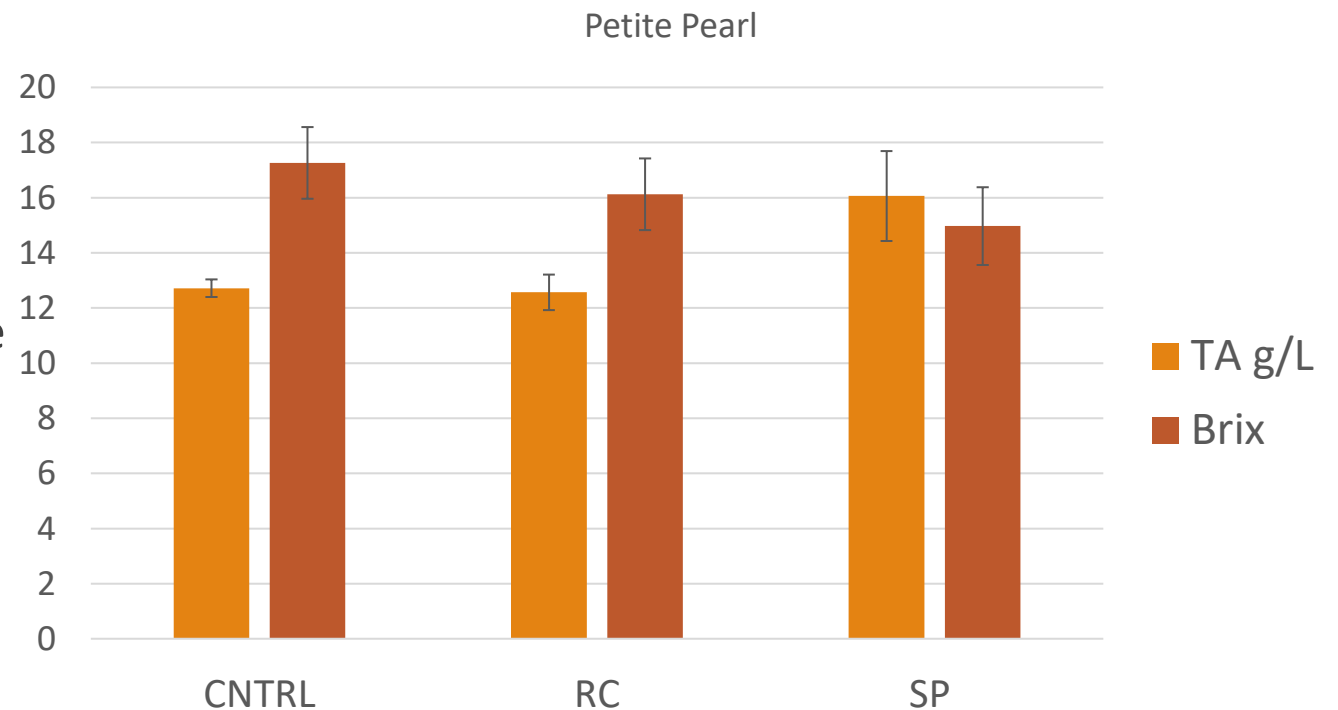


Petite Pearl

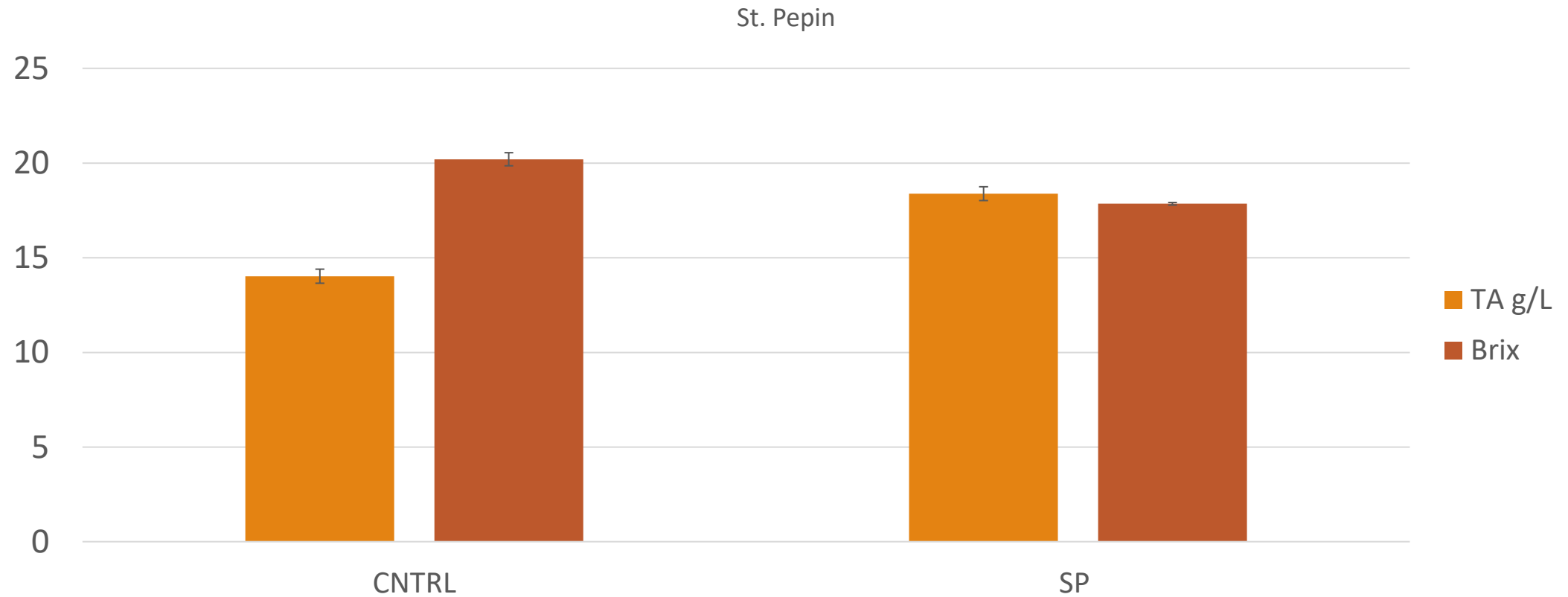


Results at harvest

- 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- slowed ripening in some varieties.



Nutrient Management

- Why do use leaf/petiole test?
- Sampled leaf tissue from red wine grapes at 11 vineyards around versaison.
 - 93% were deficient in one or more nutrients

% of samples deficient	% Vineyards	Nutrient
57	91	Copper
39	72	Zinc
32	36	Magnesium
25	36	Boron
15-24		Potassium, Calcium

Copper deficiency

- Rarely seen in other regions that use copper-based sprays in disease management programs
- Reduced growth and yield
- Short internodes
- Small and yellowed leaves
- **It's not clear if this is an issue in MT vineyards**
 - No visible symptoms
 - Evaluations of copper addition are planned



Zinc deficiency

- Symptoms appear on new leaves-shoot tips
- Yellowing between leaf veins that becomes reddish in red wine grape
- Variable berry size
- Apply 1-3 lbs./acre of zinc as foliar spray



Magnesium deficiency

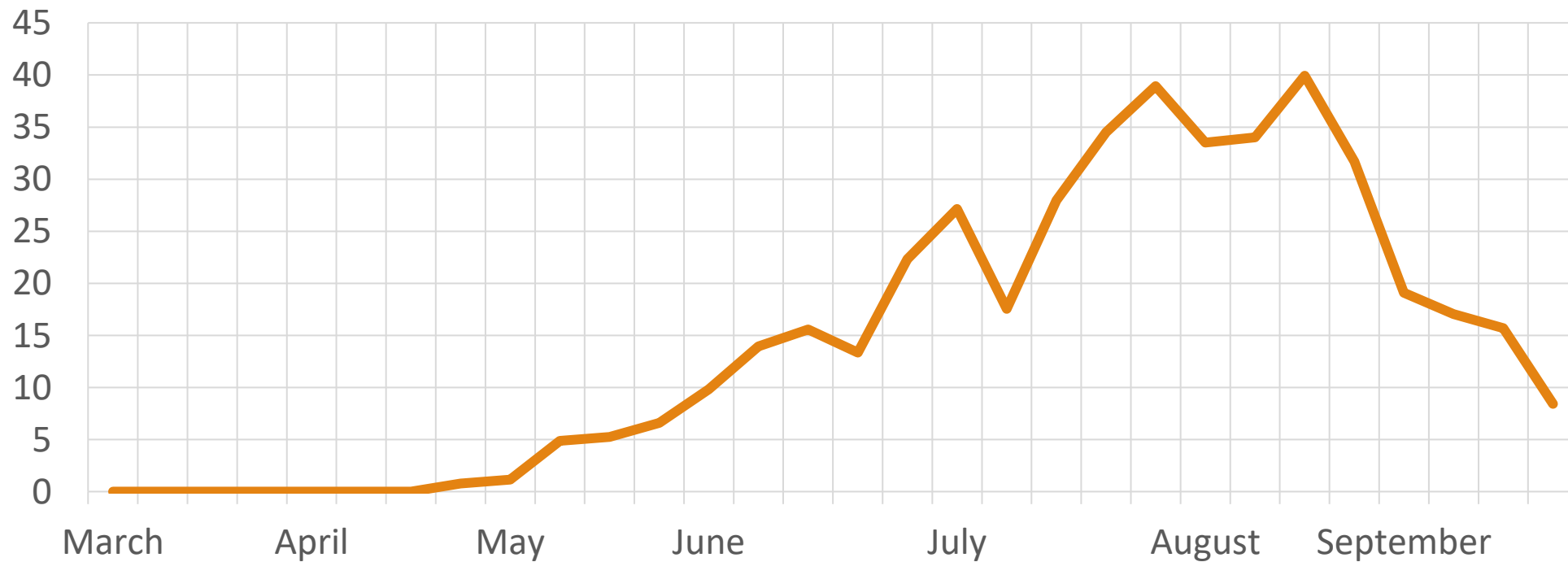
- Symptoms similar to Zinc deficiency but:
 - On older leaves
 - Yellowing starts at leaf margin and moves in between veins
- Apply magnesium sulphate (Epsom salts) or other foliar spray just after bloom.



Zinc deficiency left, magnesium deficiency right.
Zinc deficiency causes distortion of leaves as well as interveinal chlorosis.

Irrigation Management

Weekly Water Use (Gallons/vine)



Symptoms of Water Stress



Rapid Growth

Slowing Growth

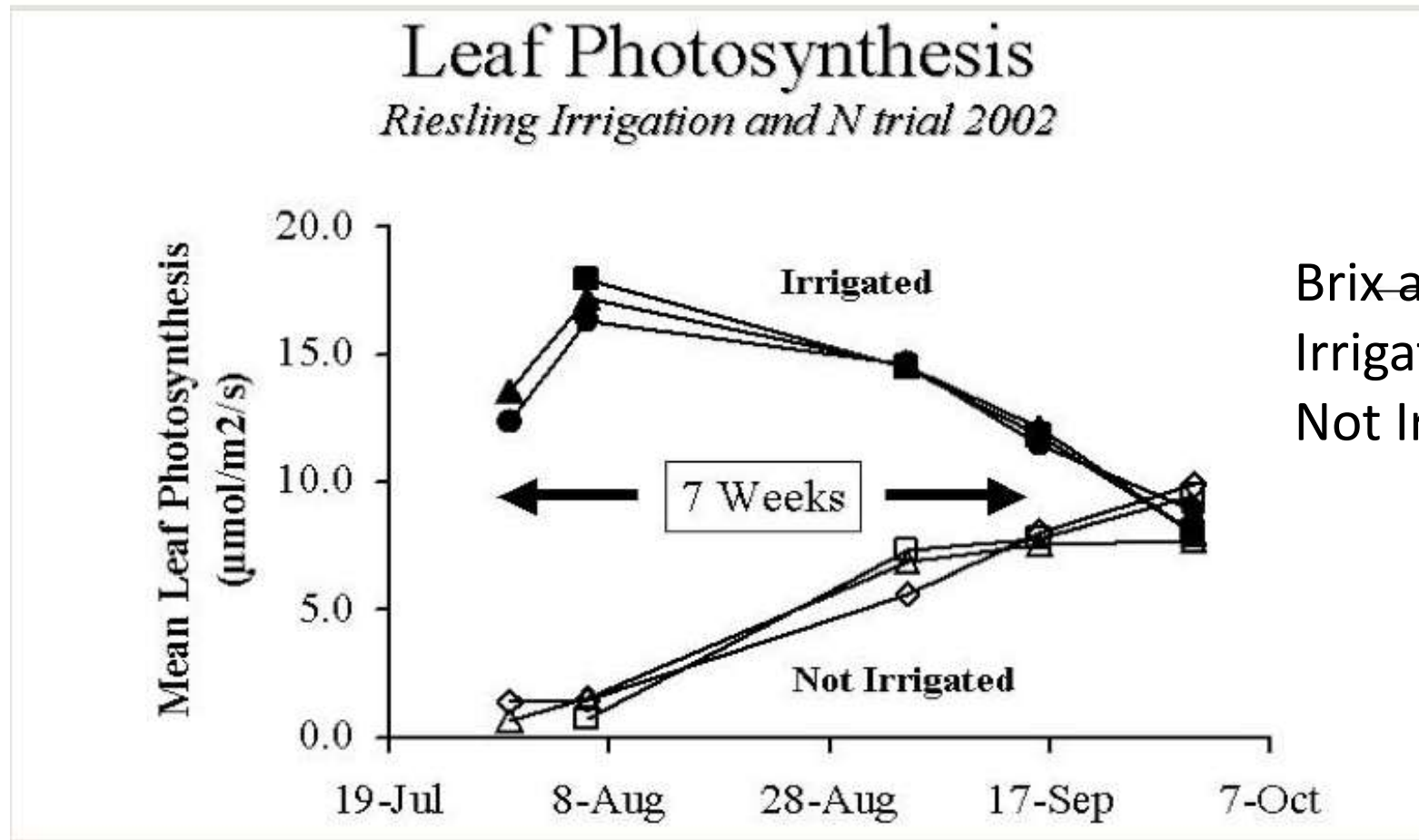
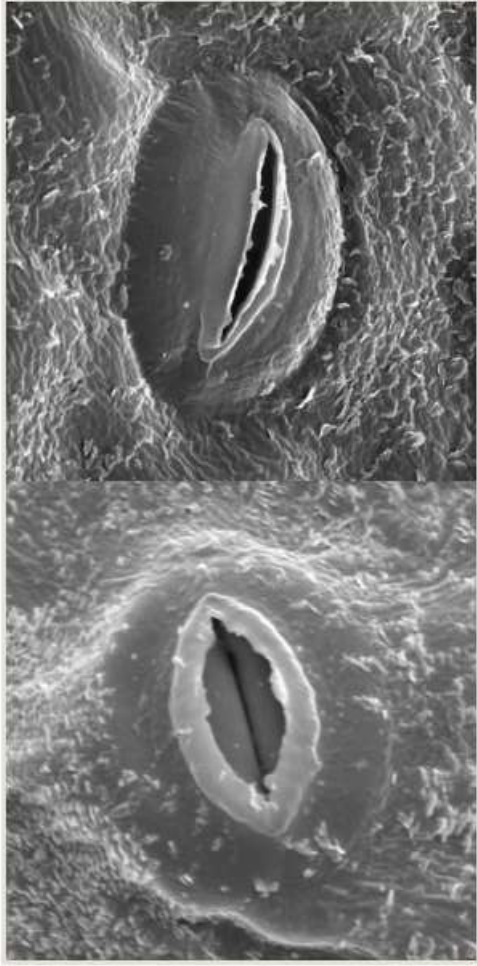
Almost Stopped

Stopped

Dead Tip

Increasing water stress

Water stress slows ripening



Brix at harvest:
Irrigated: 21.5
Not Irrigated: 18.5

Irrigation in MT vineyard



- Improving practices:
- Installed soil water meters and trained grape growers on use
- Looked for symptoms of water stress and measured stress (leaf water potential)
- No visible symptoms but 4 of 11 sites exhibited high to severe stress
- Most improved after stress measured

High Start-up Costs-Protect your investment

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- Does not include labor (2-3x)
- **Slow Return**



Protect your investment with crop and pest management

- **Relatively Easy:**

- Cool, Dry Climate reduces risk of insects and disease
- Lots of Resources MSU, WSU, USU, U of I, NDSU, Upper Midwest Universities.

- **Critically Important:** especially early on-before planting and 3-4 years post planting.

- Primary pests
 - Weeds
 - Mammals
 - Birds



Weed Impacts

Direct:

- Competition for water and nutrients:
 - 50,000-100,000 gal/ac/yr.
 - Especially intense in establishment years and with dwarfing root stocks
 - Lost returns on inputs
 - Weeds can block irrigation->water stress

Indirect:

- Provide food/habitat for rodents-winter browsing to roots and trunk





REMOVE BEFORE PLANTING



- **Spreading Perennial** are the most difficult to control
 - E.g. Quack Grass, Canada Thistle, Field Bindweed
 - Use **Systemic Herbicide** that will break down (i.e. glyphosate)
 - Multiple applications- Fall most critical

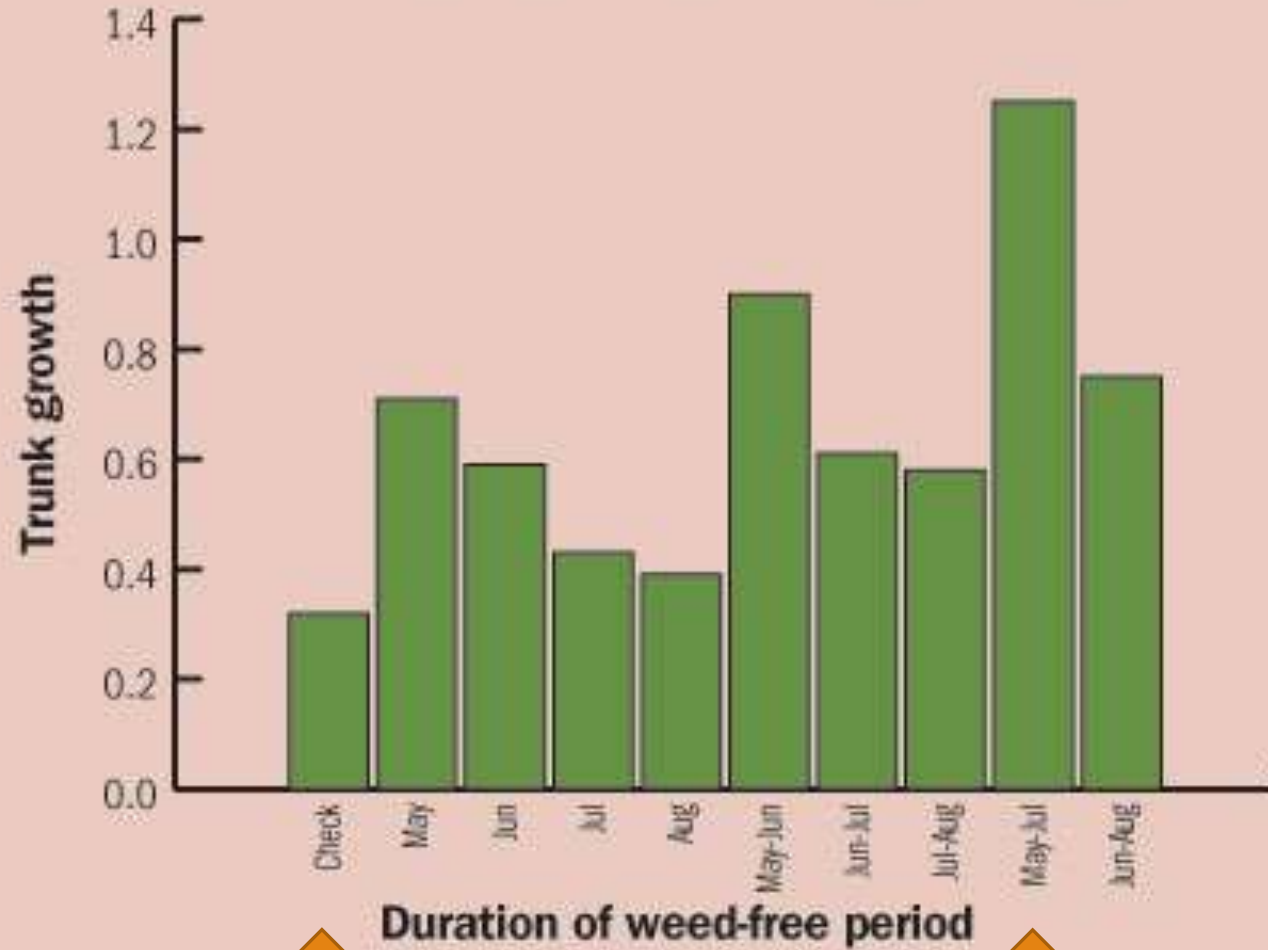
Critical Period(s)

Weed competition has greatest effects when:

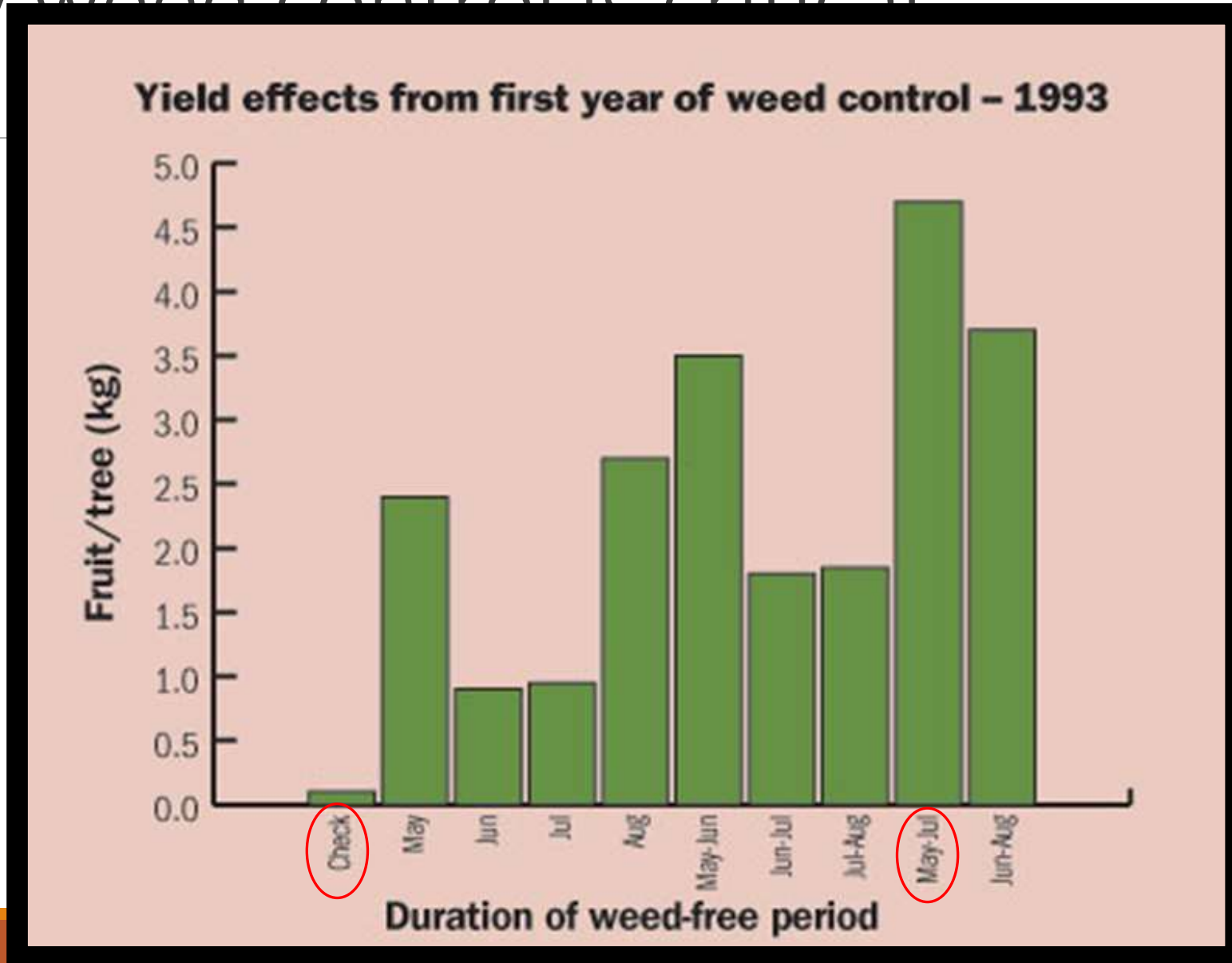
- **Vines are young**-small root system, creates lag in growth
- When vines need resources during the growing season
 - Flowering
 - Fruit set
 - Fruit enlargement (yield, size)
 - Growth (next years yield)
 - Flower bud initiation (next years yield)
- **MAY-JULY**
- Weed competition in fall can help trees harden off/prepare for winter



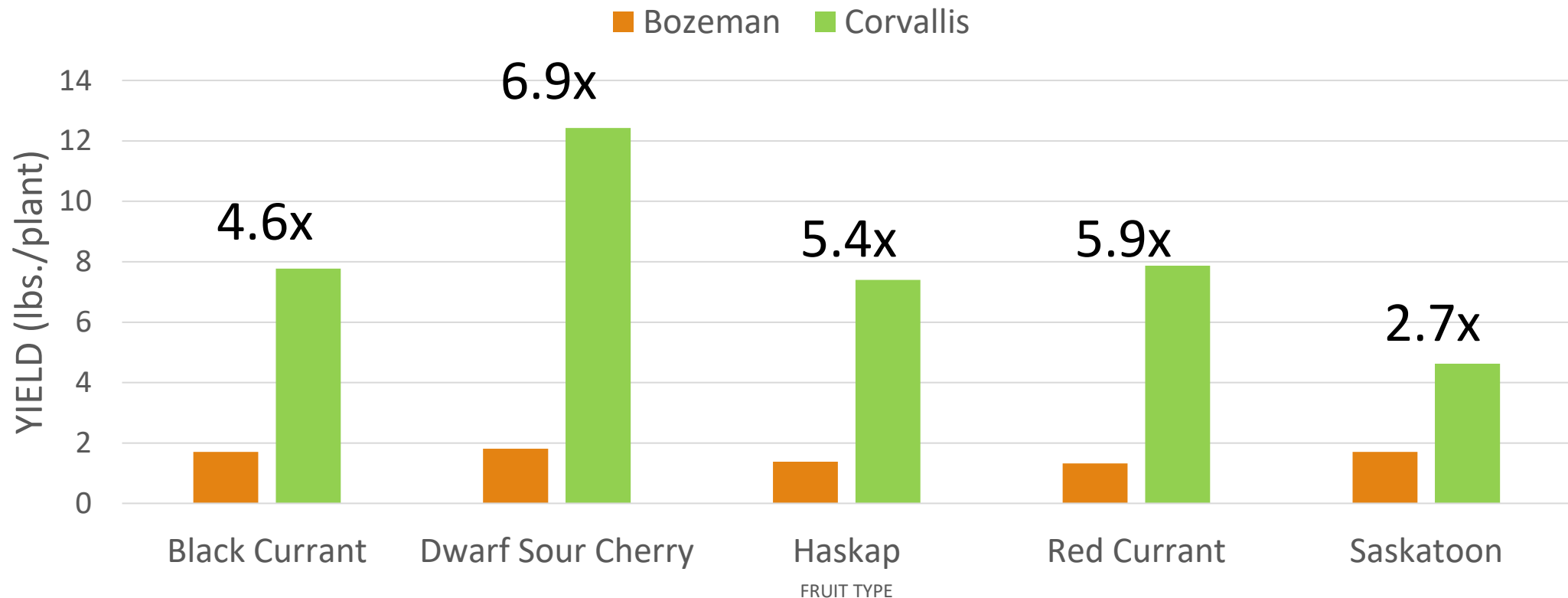
Increase in trunk cross sectional area – 1991



Early weed control is critical



Impacts of management in establishment in Montana berries.

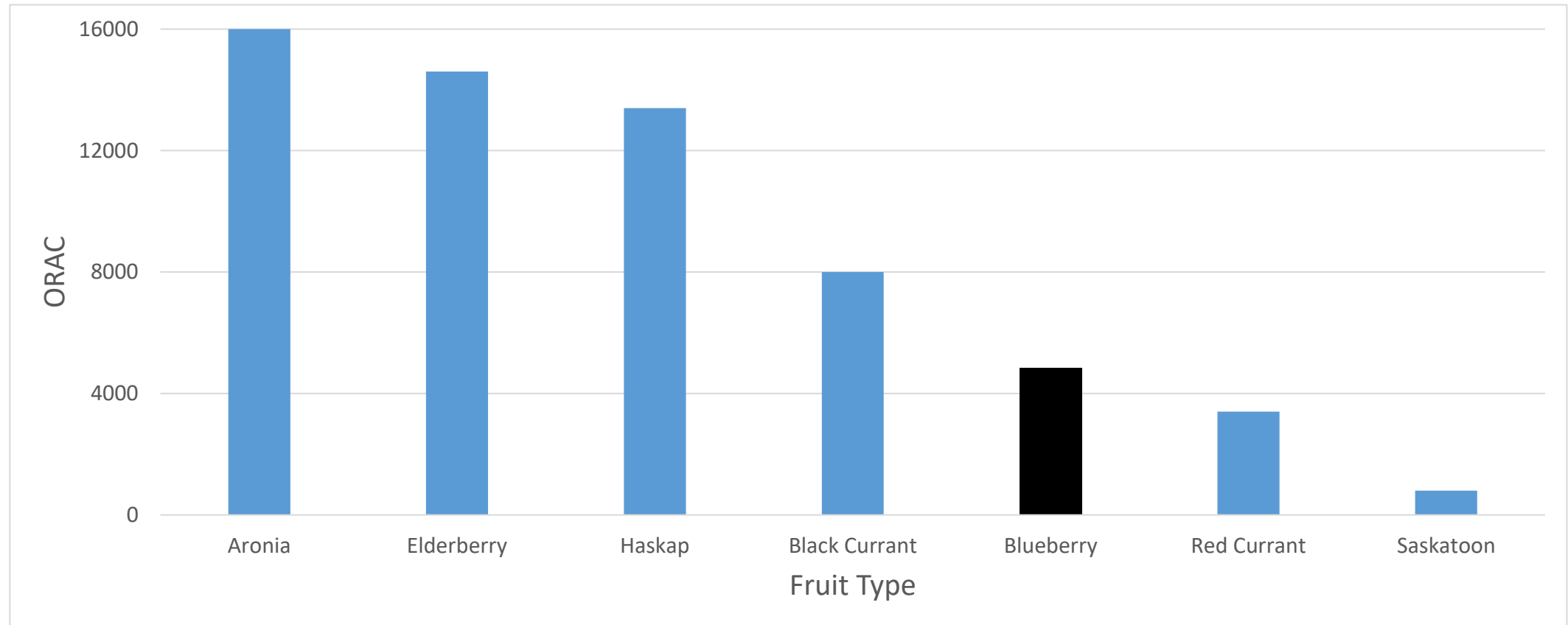


Montana-Grown Superfood Berries

- Opportunity to capture growing market for Superfoods
- Dark colored=antioxidant rich
- Cold-Hardy, Dark Fruit-Tolerate of Neutral to Alkaline Soils
 - Growing industry
 - Includes Dwarf sour cherries, Haskaps, Saskatoons, Currants, Aronia, Elderberry



Antioxidant potential (Oxygen Radical Absorbance Capacity)



A Team Effort



Montana-Grown Superfood Berries

Approach/Methods

- Evaluate
- **~50 varieties of 6 fruit types:**
 - Dwarf Sour Cherries, Currants, Haskaps, Aronia, Saskatoons (serviceberries), and Elderberry
- **Across varying growing condition:** Orchards in Corvallis, Kalispell (Organic), and Bozeman, Planted 2015
- **Winter hardiness, pests, production, and flavor, quality, post-harvest storage and processing.**



Aronia

- *Aronia (Photinia) melanocarpa*
- Commercial cultivars:
 - Half native to US
 - hybrid between mountain ash and black chokeberry
- Pure native Aronia (black chokeberry) **is not the same as commercial**
- Many commercial cultivars but not much difference
- Very high in Tannins and Anthocyanin's- for processing/blending
- Not preferred by birds
- Evaluating Viking and McKenzie (and ornamental-Autumn Magic)



Aronia

	Yields (lbs./plant)	
	2018	2019
McKenzie	16.8	16.7
Viking	15.0	11.0
Autumn Magic	2.4	3.9

- Commercial varieties much more productive and 2x berry size compared to ornamental Aronia.
- Well-adapted- no cold injury
- Pests- pear sawfly, easy to manage.

Saskatoons/Serviceberries

- *Amelanchier alnifolia*
- Native but commercial varieties are much better
- >\$20 million/year industry for Canada
- Some varieties can be machine harvested with 2-3 harvests/season
- Insect pest (Saskatoon sawfly-very damaging, difficult to manage)
- Evaluating: Smoky, Martin, Northline, Lee 3, Lee 8, and JB30.



Yields over time: better varieties =double yields and better flavor.

	Yields (lbs./plant)		
VAR	2018	2019	Total
Lee8	11.5	7.1	18.6
Northline	11.6	4.4	16.0
Smoky	8.5	5.7	14.3
Lee3	4.2	4.6	8.8
Martin	3.4	3.2	6.6
JB30	1.2	2.7	3.9

Dwarf sour cherries

- *Prunus cerasus* X *fruticosa*
- Developed by University of Saskatchewan
- Short stature-easy to harvest by hand/machine
- Great flavor/color
- Productive: up to 30 lbs/plant
- Evaluating Crimson Passion, Carmine Jewel, Romeo, and Juliet (also Lutowka Rose, *Prunus cerasus*)
- Requires pest management



Yields over time: Carmine Jewel yields may be leveling off

	Yield (lbs./plant)			
Variety	2017	2018	2019	Total
Carmine Jewel	0.7	16.7	18.1	35.5
Romeo	0.1	7.7	10.4	18.2
Lutowka Rose	0.6	5.8	10.9	17.3
Juliet	0	2.4	8.7	11.1
Crimson Passion	0	0	0	0

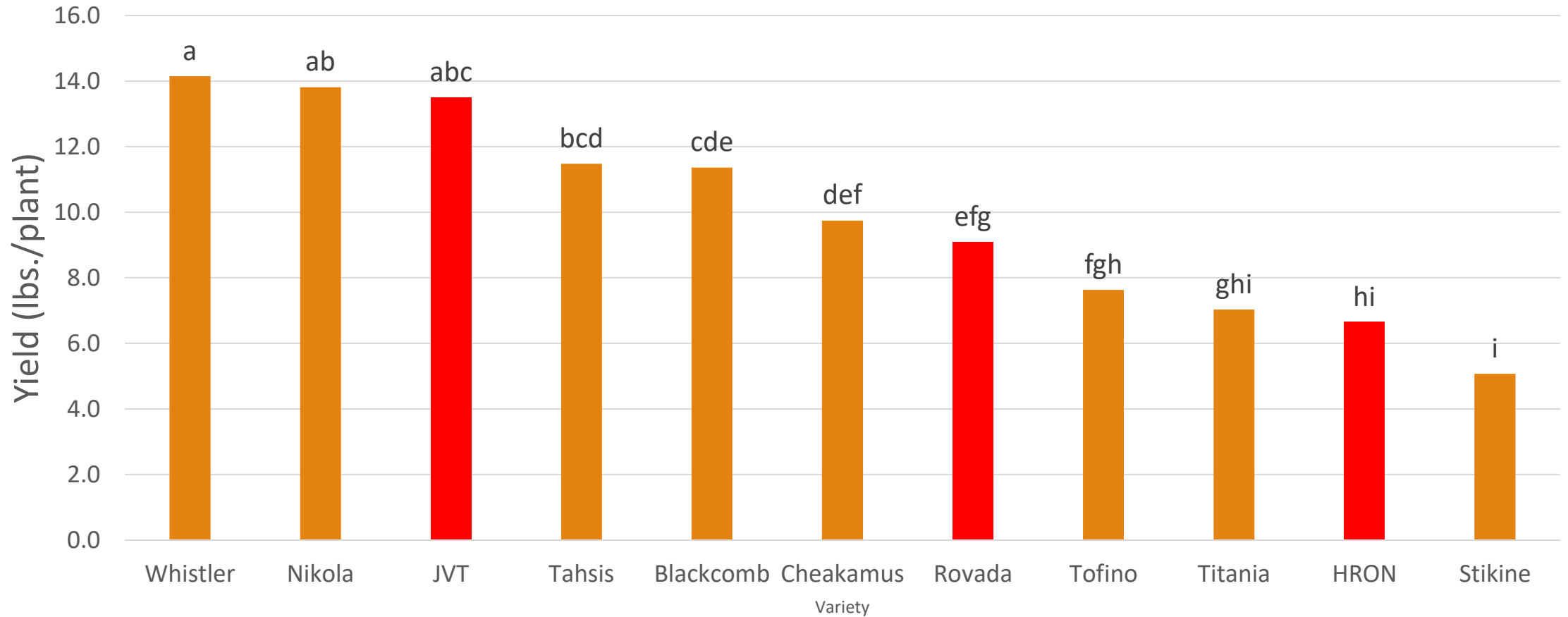
Currants



- Black (*Ribes nigrum*) and Red (*R. rubrum*)
- Productive: ~10-20 lbs/plant
- Popular in Europe, but less known in US
- Evaluating 8 types of black and 3 reds
 - Blacks: Titania, Blackcomb, Stikine, Tofino, Nicola (M12), Cheakamus, Tahsis, and Whistler
 - Reds: Jonkeer van Tets, Rovada, HRON
- Requires pest management (mostly aphids and cane borer) and annual pruning



BLACK and RED CURRANTS-2019 yields



Yields During Establishment

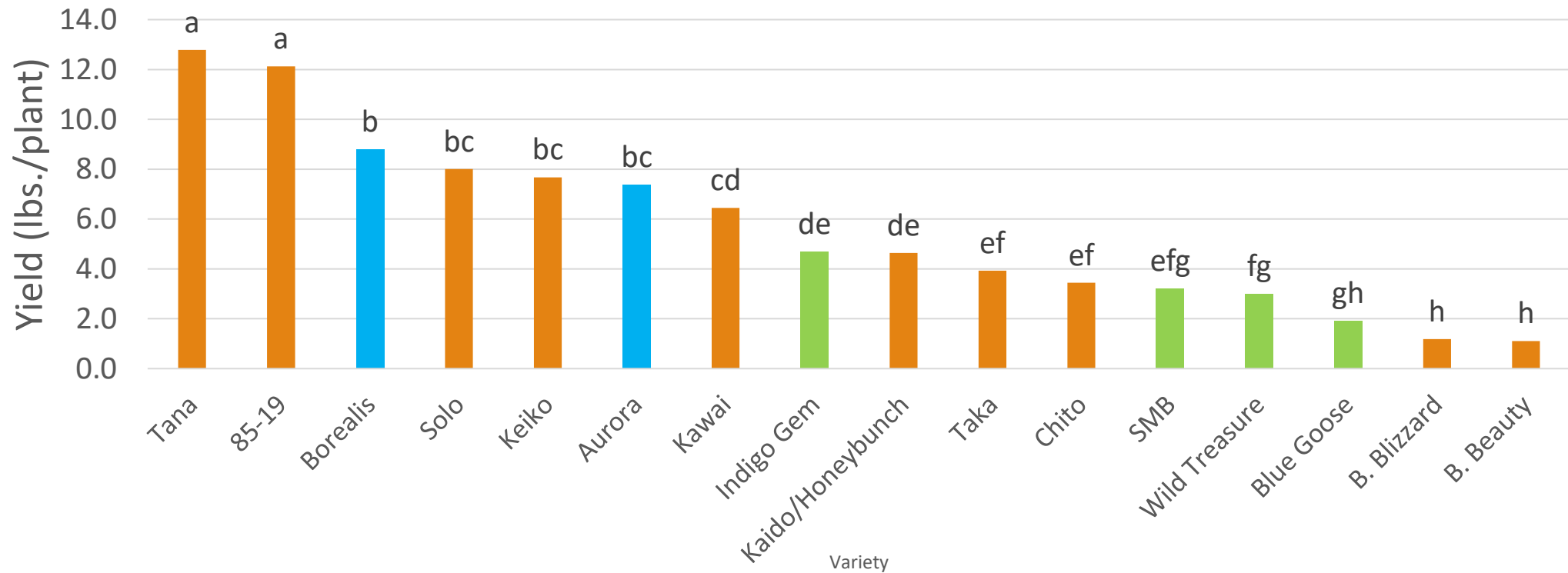
	Year since planting				
Variety	2	3	4	5	Total
Whistler	0.4	5.7	12.0	14.1	32.1
Nicola	0.5	6.0	10.8	13.8	31.0
Jonkeer Van Tets	0	3.5	13.9	13.5	30.9
Tahsis	0.4	5.3	10.9	11.5	28.1
Blackcomb	0.1	4.1	7.0	11.3	22.5
Cheakamus	0.1	3.8	6.8	9.7	20.4
Rovada	0	1.1	7.7	9.1	17.9
Stikine	0.2	2.9	9.1	5.1	17.3
Tofino	0.1	2.6	6.0	7.6	16.4
Titania	0.1	2.2	5.0	7.0	14.2
HRON	0	0.1	1.3	6.6	8.1

Haskaps/Honeyberries

- Edible Honeysuckle (*Lonicera caerulea*)
- Very diverse: variable flavor/form
- Need 2 compatible varieties for pollination
- Evaluating 15+ varieties:
 - U of Sask: Aurora, Borealis, Boreal Blizzard, Boreal Beauty, Indigo Gem.
 - Berries Unlimited: Blue Corn, Blue Goose, Wild Treasure + Sugar Mountain Blue
 - Maxine Thomson: Chito, Kaido, Keiko, Kawai, Solo, Taka, Tana, and one line from Oregon State.
- Common grower issues:
 - Bird and weed management-more later
 - Picking too early-blue outside and sour green inside



Haskap Yields: range from 1 to 13 lbs. per plant. Harvest time differs: **early**, **mid**, **late**



Haskap Yields (lbs./plant) over time:

Variety	Years since planting				Total
	2	3	4	5	
85-19	0.2	3.9	8.6	12.1	24.8
Tana	0.3	3.7	6.9	12.8	23.7
Solo	0.2	2.1	5.6	7.9	15.8
Keiko	0.3	2.8	4.7	7.7	15.5
Borealis	0.1	1.8	4.6	8.8	15.2
Kawai	0.2	3.1	4.0	6.4	13.7
Aurora	0.1	0.9	3.7	7.3	11.9
Taka	0.1	2.7	4.6	4.0	11.4
Kaido/Honeybunch	0.1	2.8	3.7	4.6	11.2
Chito	0.3	3.0	3.6	3.5	10.5
Indigo Gem	0	1.1	4.8	4.6	10.5
Sugar Mnt. Blue	0	0.5	0.3	3.3	4.1
Wild Treasure	0	0.5	0.5	2.9	3.9
Blue Goose	0	0.1	0.2	2.0	2.3

Ongoing projects: Stay tuned

- Harvest labor for hand and mechanical
- Haskap ripening and plant growth regulator treatments to reduce fruit drop (ReTain)
- Storage and shelf life
- Taste tests
- Processing quality
- Fruit chemistry (antioxidant, phenolic content, etc.)



Montana-Grown Superfood Berries

Fruit type	Uses	Pest Management	Recommended Varieties	Production (lbs./ac)
Dwarf Sour Cherry	Fresh, Frozen, Processed	Must manage insects	Carmine Jewel and others-NOT Crimson Passion	16,300
Currants	Processed	Some insect issues	Red: Jonkeer Van Tets Black: Nicola, Whistler+	14,500
Haskaps	Fresh, Frozen, Processed	Minimal	Early- Indigo Gem Mid-Aurora, Borealis Late-Several	12,000
Aronia	Frozen, Processed	Some insect issues	Commercial Varieties NOT ornamental	10,000
Saskatoons	Fresh, Frozen, Processed	Must manage insects	Northline, Lee 8, Smoky NOT JB30	10,400
Elderberry	Processed	Minimal	Bob Gordon, Ranch, Adams	2,400

Fruits Work Well Together

	June	July	August	September
Haskaps				
Saskatoons				
Sour cherries				
Currants				
Aronia				



You are invited to join us!

Hig

Montana Berry Growers Association 1st Annual Educational Conference and Meeting

April 17-18th, 2020

Bozeman, MT

Fruit

Haskaps

Aronia

Currants

Saskatoo

Dwarf So
Cherries

Join the Montana Berry Growers Association, Montana Agricultural Experiment Stations, and MSU Extension for a two day conference filled with information about the emerging markets and opportunities for berries in Montana.



Speakers include:

- Dr. Bob Bors, University of Saskatchewan, breeder/ developer of several commercial cultivars of berries and dark fruits.
- Bernis Ingvaldson, HoneyBerry USA, nursery and producer of berry varieties in Minnesota.
- Dr. Kathy Wiederholt and Kyla Splichal, NDSU Agricultural Experiment Stations.
- Dr. Zach Miller, Dr. Rachel Leisso, Dr. Wan-Yaun Kuo, and Dr. Mac Burgess, Montana State University.

Full agenda attached

Goal

1. Develop Business/Market Plan

2. Selecting Varieties Adapted to Climate, Farm, and Markets.

3. Protecting Investment Through Good Management-Critical During Establishment



Thank you-Questions?



http://agresearch.montana.edu/warc/research_current/



MONTANA
STATE UNIVERSITY



Improving yields and quality of wine grapes and wine.

Optimizing plant nutrition and crop loads for grape quality and yield

Improving irrigation practices for cold-hardy, hybrid grapes

Identifying fruit varieties suited for wine making

Deliver needed research/education for MT vineyards and wineries

Growing Fruit for profit

Opportunities:

- Growing demand
- High value per acre
- Adapted cultivars
- Favorable climates

Challenges:

- Marketing/Market access
- High start-up and labor costs
- Slow return on investment
- New and untested cultivars
- Variable climates
- Steep learning curve- less forgiving, more risk than annual crops

Bird Protection

- Can remove 50 to 99% of the berry or grape crop
 - Aronia less attractive to birds
- Exclusion vs. Deterrents
- Two types of exclusion
 - Row cover
 - Orchard Cover-Full Enclosure



Orchard Cover-Full Enclosure

E.g. Smart Net System

- Advantages:
 - Can work under net
 - Better for mixed orchards/U-pick
 - Better bird protection-can't reach fruit
- Disadvantages
 - Cost: need to add ~10 ft. tall posts every 50 ft.
 - ~\$3,700 per acre



WWW.smart-net-systems.com

250-890-0841 Canada

Row cover

- Advantages:
 - Cost: \$850-1,800/acre.
 - Netting: \$800-1,200/ac
 - Support, stakes: \$630/ac.
 - **Allows mechanical harvest.**
- Disadvantages
 - Less effective: birds can reach fruit
 - Can't work under net- must remove to prune, spray, monitor, and harvest

