

Addressing Research Issues Facing Midwest Wine Industry

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Finding Suitable Varieties to Grow

- One of the problems growers face in these regions is selecting cultivars (cultivated varieties) that will withstand our severe winters, mature during short growing seasons, and be productive.
- With the high costs of vineyard establishment, there is an increasing need for selecting the best adapted cultivars.
- When selecting grape cultivars to grow, one must consider the characteristics of the fruit as well as the vine.
- This project was undertaken by many states.

Cultivar Evaluation Other States

- Evaluate cold climate cultivar performance under a wide range of climates throughout the Upper Midwest and Northeast to match cultivar with site.
- Studies being conducted are in many states as a part of NE 1020 program

As a part of NG project, fruit is being collected from multiple sites and is being analyzed for harvest parameters, sugar and organic acid profile

Best Viticultural Practices Training, Canopy management & Crop load

- The Northern Grapes viticulture team has undertaken studies to evaluate crop and canopy management strategies to minimize fruit acid content and improve fruit composition in high-acid, cold climate grape cultivars.

These studies include the evaluation single and divide canopy

- **training systems**, (GDC, VSP Scott-Henry)
- **canopy management** practices to improve light distribution,(shoot thinning, lateral shoot removal and shoot positioning)
- **and crop load management**.(various amount of crop)

Nutrition& Pest Management

- Goal is to determine optimal mineral nutrition and soil management practices for cold climate grape cultivars.
- Develop sustainable pest management recommendations based on cold climate cultivar copper and Sulfur sensitivity and disease resistance

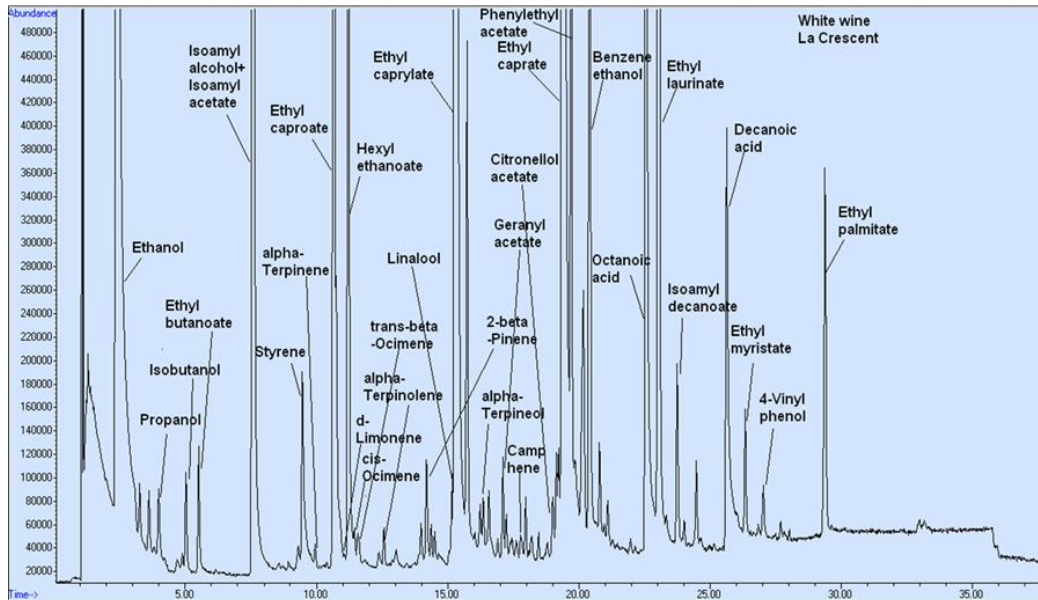
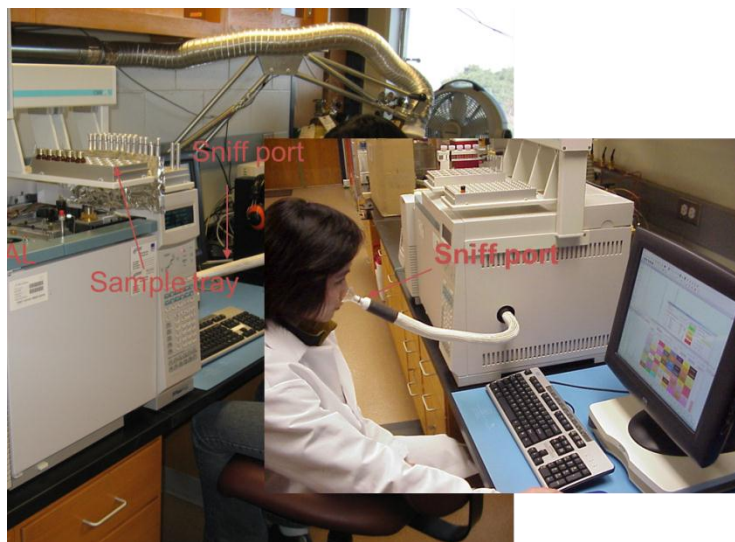
Fruit Composition

- Characterize the changes in fruit composition during ripening phase and how they influence grape quality(aroma)
- The goal is to link analysis of gene expression with aroma compounds and relate them to sensory changes during ripening
- The objective is to determine harvest based on aroma and flavor and not only on sugar, TA and pH



Aroma and Flavor Research

Simultaneous Chemical and Aroma Analysis

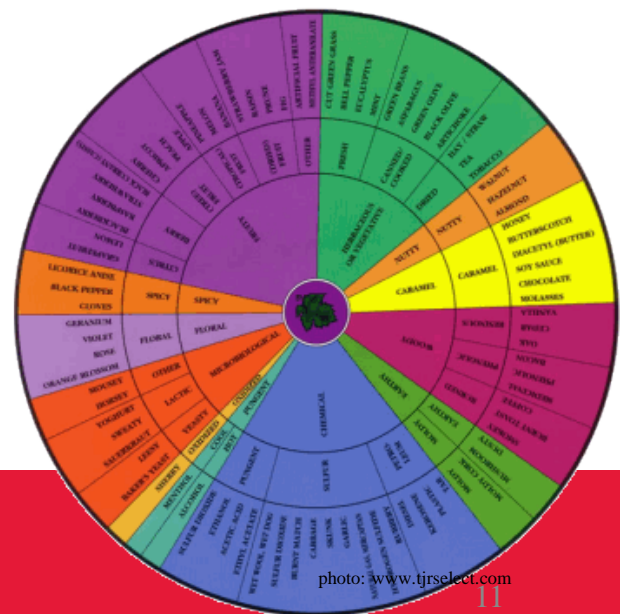


La Crescent Aroma Research



Methods – Descriptive Analysis Panel Training

- IRB approval
- Panelists
 - Self-selected; consume and enjoy wine
 - 11 panel members
 - 21-55 years, 8 women, 3 men
- Training
 - 7, 1-hour sessions
 - White wine aroma descriptors
 - Term generation; commercial wines
 - Use of reference standards; aromas
 - Intensity rating on 15-cm line scales
 - Aromas, flavors, sweetness and acidity



La Crescent Wine Attributes by Intensity

La Crescent wine attributes by intensity, years 1 and 2 ^a			
	Year 1		Year 2
Wines	Aroma	Flavor	Aroma
Commercial La Crescent	Grapefruit Pineapple Apricot	Apricot Pineapple Lychee	Rose Lychee Peach
Research La Crescents	Grapefruit Pineapple Rose/Lychee ^b	Grapefruit Pineapple Lychee/Apricot ^b	Rose Lychee Grapefruit

^aListed in order of average intensity ratings (top three attributes) of LS means (11 panelists, 3 replicates).

^bResearch La Crescent wines did not agree in order of 3rd attribute(year 1), listed unsweetened/sweetened.

Effect of Skin Contact Temperature on Aroma Profile of La Crescent

- The varietal aroma compounds are predominantly located in the skin
- Research has shown that the wine aroma can be enhanced with skin contact treatment **prior to fermentation**
- However, skin contact can also contribute to astringency and browning potential depending on maceration conditions
- The aim of this study is to determine the effect of skin contact on the aromatic intensity of La Crescent wine

Research Method

- Grapes for this research were provided by Tassel Ridge winery
- Healthy La Crescent were hand harvested and transported to CCUR facility in Ames, IA
 - 20.3 Brix, 3.23 pH, 12.2 g/L TA
 - Grapes were divided into 3, 276 lb batches (A,B,C)
- All batches were de-stemmed, crushed and placed into 30 L food grade plastic containers for additions
 - SO₂ (40ppm) and Enartis RS enzyme (0.015ml/L) added to each batch
 - Batches A & B remained in 30L containers for 24hr skin contact treatments
 - Batch C was pressed and placed in cooler (45 °F) to settle (48 hr total)
 - Following 24 hr treatments, A&B were pressed and placed in cooler to settle (24 hr total)

Batch Treatments

A - Skin contact for 24 hr at ambient temperature (70 °F)

B - Skin contact for 24 hr at cooler temperature (45 °F)

C - No skin contact/control

Winemaking

- Each batch was racked off the sediment, inoculated with Vitlevuere 58W3 yeast and go-ferm nutrient, and fermented in triplicate
- The juice was fermented at 55°F, and completed after 23 days
- At dryness the wine was racked, SO₂ (40ppm) and Lallemand Beta enzyme (7.5g/hL) added
- At 2nd racking wines were treated with bentonite (0.5 g/gal) and sparkolloid (1.0 g/gal) and SO₂ adjustment by pH
- After the wine became clear, it was racked a 3rd time and SO₂ adjustment by pH
- Prior to bottling wines were filtered, RS adjusted to 2.50%, SO₂ adjusted based on pH and sorbate added (225mg/L) to wine and bottled.



Crushing & De-Stemming



Yeast Inoculation



Labeling Fermentation Lots



Racking



Bottling

Next is:

Industry tasting

Sensory evaluation to find if skin contact affects wine aroma

Chemical aroma profile of wines



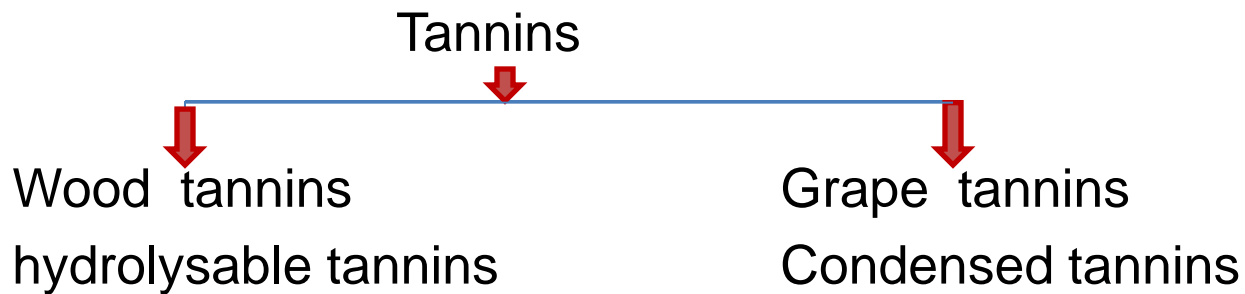
Tannin Research

Why Tannins Matter?

- Contribute to mouth feel/taste/structure/body
- Stabilize wine color
- Protect against oxidation.
- Assist to precipitate proteins, thus acting as fining agent
- Modify aromas including vegetative aromas
- Increase aging potential

Cold climate grapes are low in tannins and research is needed to investigate the effects of tannin additions on wine quality.

Tow Major Classes of Tannin



Hydrolysable Tannins

- Wood tannins/Hydrolysable tannins are copolymers of gallic acid and ellagic acid bound to sugars (mostly glucose) and are called gallotannins or ellagitannins.
- Upon hydrolysis they yield gallic and ellagic acids.
- They can be extracted from oak barrels during oak maturation of wine.
- They can also come from the addition of enological tannins.
- Sources of wood tannins include:
 - Oak barrels, oak alternatives, oak gall nuts
 - Tara, (a south American bean) and Quebracho (a tree from South America)

Condensed Tannins

Generated by polymerization of flavonoid phenolic units.

The structure is complex and then complexity may result due to:

- Flavanol variation (catechin, epi-catechin, epi-gallo catechin, epicatechin gallate units)
- Degree of polymerization(length of chain)
- And linkage variation. (4-6 or 4-8 inter-flavan bonds)

Seed vs. Skin tannins

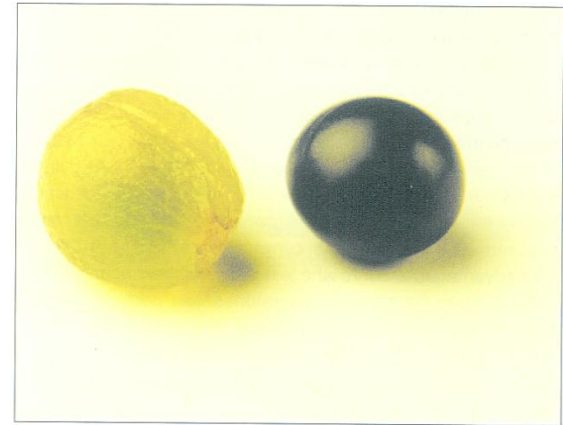
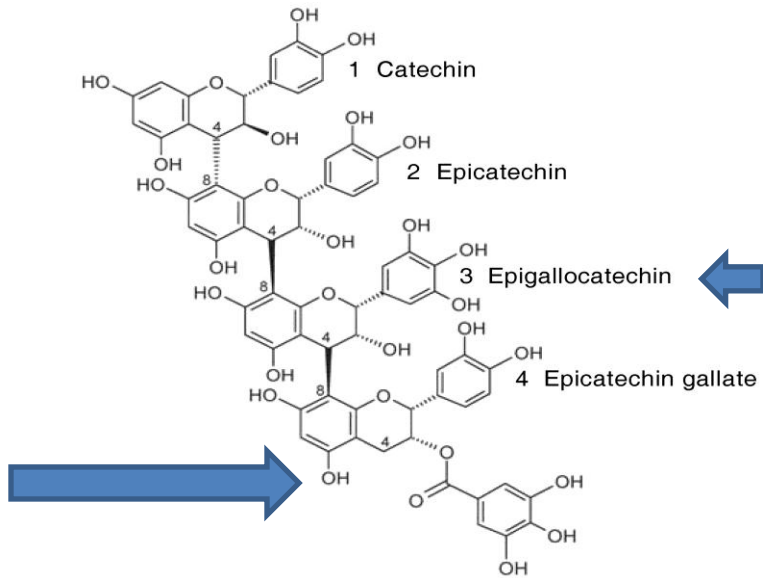
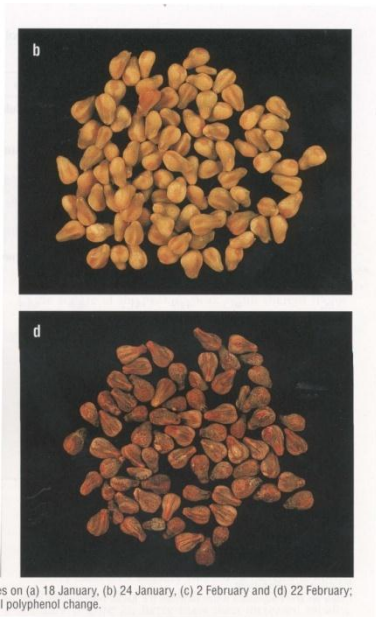


Figure 19. Colour molecules are concentrated in the skin of most grape varieties, as can be seen in this photograph of a red grape (right) and a peeled red grape (left).
Source: *Australian Wine—from the vine to the glass*. (Iland and Gago).
Photographer: Stan Richards

Hypothetical example of condensed tannin structure

Source: Adams 2006

Tannins and Total Anthocyanin Content of Grapes and Wine (mg/l)

	Marquette		Frontenac		Vinifera	
	Grapes	Wine	Grapes	Wine	Grapes	Wine
Tannins	391	207	483	224	--	1-3 g/L
Total Anthocyanins	743	640	960	601	1610	1207

This data represents one year and one Iowa location.

These varieties contain relatively lower amounts of tannin, and therefore we need to evaluate if enological tannin addition can help produce high-end red wines.

In vinifera world, for harmonious development of wine in bottle, the T/A ratio should be between 1 and 4, i.e. 500mg/l of Anthocyanin and 1-3 g/l of tannin (P.Ribereau-Gayon et al 2000).

Enological Tannins Addition Trial at ISU

- We wanted to study the test the effects of enological tannin additions on the color and mouthfeel of qualities of red wine
- Research was conducted at ISU & Tassel Ridge winery to evaluate the effect of enological tannin additions on the phenolic composition of Marquette and Frontenac wines

Enological Tannins and Rate of application

Type of tannin	Rate mg/l	Timing of addition
Control	0.0	No tannin addition
Ft. Rouge Soft	1200	beginning of fermentation
Uvatan Soft	400	beginning of fermentation
	400	after 1 st racking
Tannin Estate	400	after 1 st racking
Tannin Riche	400	after 2 nd racking
Ft. Rouge Soft	600	beginning of fermentation
+ Uvatan Soft	200	beginning of fermentation
+ Tannin Riche	200	after 2 nd racking

Tannin research at Tassel Ridge

- Racking wine



- Tannin addition



Results of Marquette wine

1. Tannin addition treatments had no effect on wine parameters such as pH, TA, VA, ethanol, and SO₂ levels

ETS lab did the phenolic profile analysis of the wines about 6 months post treatment.

- Only a small amount of tannin was recovered as compared to what was added.
- This means a major portion of added tannins **were lost** and could not be accounted for. (suspect pathogenesis Related protein may be involved)
- A large proportion of pigments were present in monomeric form indicating very little formation of polymeric pigment.
- These cultivars may have different pigment profile compared to Vinifera
- For all Marquette treatments the addition of enological tannins resulted in a change in the sensory perception of the wine

Other Issues

- *White wines*
 - High TA
 - High malate
 - High K
- *Red wines*
 - Different pigment profile
 - Low tannins

Cause of High TA

- Cooler night temperatures (<15 0C) during berry ripening,
 - frosty sites,
 - and excess soil moisture,
 - shaded cluster (<60% clusters exposed),
 - high crop load (>10kg/kg pruning weight produces high TA.
- Canopy management and crop load control should help reduce TA in vineyard.
- macro climate can not be easily changed . So need to rely on site selection and viticultural practices
- In cellar, biological and chemical de-acidification may be needed to lower TA

High Malic Acid at Harvest

To address this challenge:

- Match growing site to variety
- Delay harvest but increasing pH is a risk that needs to be considered when making harvest decision
- Use Malic acid degrading yeast for fermentation
- Consider partial chemical and biological de-acidification

THANKS

