Making, Blending, and Selling Wines
From Cold Hardy Cultivars

Stephen Menke
Colorado State University-WCRC
Desirable Traits in Hybrid Grape Wines

- Great fruitiness
- Usually good color
- Sufficient acid
- Great taste intensity upon presentation to mouth
- Good food pairing
- Good dry or sweet
Problem Traits in Hybrid Grape Wines

- Some strong varietal aromas and tastes
- Can be too acid
- Tannins low
- Prone to structural breakdown of flavor and body
- Sweeter wines prone to re-fermentation
Cool Climate *Vitis vinifera* Intraspecific Crosses

- **Cool Climate** = winter minimum of -5°F to -15°F, and depends on acclimation
- **Lemberger** (red, moderate cold resistance, fruity, good wine quality)
- **Comtessa** (red used for white, moderate cold resistance, fruity wine)
- **Siegerrebe** (white, fairly cold resistant, very floral wine)
- **Noblessa** (white, moderate cold resistance, good wine quality reported)
- **Morio muscat** (white, moderate cold, northeast US, very floral and fruity)
- **Madeleine Angevine** (white, moderate cold, good wine quality reported)
Cool Climate Hybrids/Natives

- **vinifera/American, vinifera/amurensis**, Cornell, Minnesota, UC Davis
- Useful site
  [http://viticulture.hort.iastate.edu/cultivars/cultivars.html](http://viticulture.hort.iastate.edu/cultivars/cultivars.html)
- Cool Climate = winter minimum of -5°F to -15°F, and depends on acclimation
- Reds
  - Baco noir, Chambourcin, Chancellor, Concord, Corot noir, Crimson cabernet, DeChaunac, GR7, Kozma 55, Kozma 525, Landot noir, Leon Millot, Marechal Foch, Noiret, Norton, St. Vincent
Cool Climate Hybrids/Natives

- *vinifera/American, vinifera/amurensis, Cornell, Minnesota, UC Davis*
- **Cool Climate** = winter minimum of -5°F to -15°F, and depends on acclimation
- **Whites**
  - Catawba (rosé), Cayuga white, Chardonel, Delaware, Niagara, Seyval blanc, Traminette, Valvin muscat, Veeblanc, Vidal blanc, Vignoles
Cold Climate Hybrids

- Swenson, Minnesota, Cornell, etc.
- **Cold Climate** = winter minimum of -15°F to -30°F, depends on acclimation
- Reds
  - Baltica, Frontenac, Marquette, MN 1200, Sabrevois, St. Croix, Temparia, Valiant, Zilga
Cold Climate Hybrids

- Swenson, Minnesota, Cornell, etc.
- **Cold Climate** = winter minimum of -15°F to -30°F, and depends on acclimation
- Whites
  - Alpenglow, Brianna, Edelweiss, Espirit, Frontenac gris (gray used for white), Kay Gray, LaCrescent, LaCrosse, Louise Swenson, Petite Amie, Petite Jewel, Prairie Star, Skujinsh, St. Pepin, Swenson white, Ventura
Winemaking in Cool/Cold Climates

- General fruit harvest characteristics
  - Supply affected by late spring/early fall frost damage
  - Ripeness affected by early fall frosts
  - Acids often higher (cool nights during veraison)
  - Can have both high pH and high acid
  - Ripeness of skin/seeds vs. Brix not always consonant
    - Tannin and/or color may be lower
  - Canopy management for berry ripeness essential
  - Irrigation surplus/deficit can affect flavors
Winemaking in Cool/Cold Climates

- **Hybrid fruit harvest characteristics**
  - Not usually suitable for high Brix winemaking
    - Can have stronger native flavors with higher 0°Brix
    - May need to limit skin contact and/or vint at below 20 0°Brix
  - Acids in hybrids are often very high (above 10 g/L)
    - Often need to blend with lower acid wines
    - Often need to do malolactic or salting out
    - Sometimes high pH with high acid
  - Tannins lower
    - May need tannin additions
  - Berry Sensory Evaluation very helpful
    - Style selection very important
Winemaking in Cool/Cold Climates

Must modifications

- Check must for $K^+$, TA, pH, and organic acid profile
- If high acid/normal pH and $K^+$
  - blend with lower acid must
  - wait and do malolactic on wine
- If high acid/low pH, normal $K^+$
  - can seed with bitartrate to precipitate bitartrate
  - can add $K_2CO_3$ or $CaCO_3$, can affect flavor & texture of wine
- If high acid/high pH
  - Blend with low acid and low pH must
  - If high $K^+$, and $< pH 3.6$, can seed with tartrate to precipitate bitartrate
  - If $> pH 3.6$, can use electrodialysis to replace $K^+$ with $H^+$
Winemaking in Cool/Cold Climates

- **Must modifications**
  - Hybrids need more pectinase added to must
    - 25-50 mL of 10% solution/ton grapes (use pectinase with low cinnamyl esterase and low anthocyanase)
    - Press whites and remove heavy lees quickly
  - Many hybrids have low tannins
    - Tannin and enzyme additives may be useful
    - Hot pressing may be useful to mature tannins and color
  - Some hybrids have vegetative or “funky” musts
    - Grape and/or oak tannins in must during fermentation may be useful
Winemaking in Cool/Cold Climates

- **Tannin Anomalies in Hybrids**
  - Hybrid wines mostly low in tannins → need to find ways to enhance tannin.
  - However, some hybrid grapes have as much tannin as *vinifera* grapes.
  - Some *vinifera* grapes have much lower tannin in wines.
  - ∴ Extraction of tannins different for different cultivars and possibly for each vintage, especially for hybrids.
  - Hybrid skins physically different post-fermentation than *vinifera*.
Winemaking in Cool/Cold Climates

- Tannin Anomalies in Hybrids
  - Conclusion is that differences in tannin extraction may reflect physical or chemical sequestration
  - how they are bound in the skin matrix
  - Differences in bonding properties in complex chemical associations
Winemaking in Cool/Cold Climates

- **Hybrid Fermentations**
  - Yeast needs similar to *vinifera*
    - Condition yeast with vitamins, amino acids, yeast metabolites, and nitrogen
    - Add nitrogen in parts to fermentation
  - Yeast matching with hybrids in its infancy
    - Lallemand has listing in 2013 catalog
    - Mixed results with yeast with malolactic capabilities
  - Can try malolactic co-fermentation w/high acid musts
    - Both reds and whites can benefit
Winemaking in Cool/Cold Climates

- Hybrid Fermentations
  - Temperatures
    - similar to vinifera for both whites and reds
    - sometimes cooler reds to minimize skin extraction
  - Pressing reds
    - Extended fermentation on skins not usually recommended
    - Lighter pressing reduces “hybrid” flavors
Winemaking in Cool/Cold Climates

- **Cellaring Hybrids**
  - More subject to H$_2$S during fermentation
    - Keep careful watch during and right after fermentations
    - Aerate and use free SO$_2$ and/or copper sulfate if needed, early in cellaring process
  - Avoid waiting to do malolactic until warmer weather
  - Do protein tests and any resulting fining early
Winemaking in Cool/Cold Climates

Hybrid wine styles

- Many hybrids bottled early, unoaked and fruity
  - Usually good food and restaurant wines

- Many hybrid wines have high acid and can be sweetened to good sweetness/acid balance
  - 1 to 8% residual (7 to 12 g/L acid), plus potassium sorbate

- Many make good late harvest or ice wines or ports

- If aging reds, tannin addition to must and/or heavier oaking can be useful
Winemaking in Cool/Cold Climates

- **Hybrid wine blends**
  - Many hybrids blend well with *vinifera*
    - Usually good food and restaurant wines
    - Can use to adjust acid and alcohol and fruitiness or spiciness
    - Flavor profiles need to be carefully adjusted while blending
    - Usually start with high ratio, either way
Grande Valley *Vitis vinifera* dependent

- Mixture of warm and cool *Vitis vinifera*, irrigated, some sites better for less cold-hardy hybrids

Great Plains, High Plains and Mountain sub-regions

- Cool or cold climate viticulture w/varied moisture
- Hybrids, *Vitis labrusca, Vitis vinifera* all grown
Niche Market Strategies in Cool/Cold Climates

- Make reputation with standard *vinifera* and add cold tolerant grapes later
  - Limited suitable sites $\rightarrow$ limited volume and limited market penetration
    - Vineyard sites may not be near market population
  - Competition with cheaper wine from known reputation regions
- Hard to make local standard *vinifera* terroir compete with known reputation regions
Niche Market Strategies in Cool/Cold Climates

- Create new markets with cold tolerant varieties
  - Many suitable sites $\rightarrow$ unlimited potential volume $\rightarrow$ pervasive market penetration possible
    - Vineyard sites near market population $\rightarrow$ familiarity
  - Niche variation means little competition

- Definitions of niche wine quality must be created
  - Whole market must be created from scratch
    - Dedicated pioneer growers and winemakers
  - Consumer education and winemaking skill take time
    - Local winery tasting rooms, farmer’s markets, restaurants essential to education of consumer and marketing players
National and International Marketing Possibilities

- Regional, Sub-regional, AVA ➔ Terroir and Style Niches
  - Niche definition especially important in developing regions
- Newer cool climate regions are innovation hot spots
  - Standard *vinifera* varietals in better parts of cool region
  - Unusual *vinifera* varietals in moderately cold parts of regions
  - Inter-specific hybrids and native American in coldest regions
    - 19th and early 20th century by American and French breeders
    - New York breeding in 20th and 21st centuries
    - Wisconsin/Minnesota breeding in 20th and 21st centuries
National and International Marketing Possibilities

- Niche regional wines: cool climate marketing
  - Varietals
    - Standard *vinifera*
    - Hybrids of *vinifera* and native species
    - Hybrid backcrossed w/hybrid or *vinifera*
    - Unusual *vinifera or vinifera/vinifera* cross
National and International Marketing Possibilities

- Niche regional wines: cool climate marketing
- Blends
  - Standard *vinifera*
  - Unusual *vinifera*/*standard vinifera*
  - Hybrid/*vinifera*
  - Hybrid/hybrid
  - Hybrid/*vinifera*/*labrusca*
ADVANTAGES OF BLENDS
REGIONAL STYLES AND TERROIR

- Unique Aroma and Flavor Identities
  - No competition in niches in all of world
  - When identity established $\rightarrow$ scarcity $\rightarrow$ higher prices
- Great fit with grapes grown in all parts of region
  - Specialization of expression of local terroir effects
  - Model from other regions + cuisine co-development
- Diverse palette to create wines for foreign tastes
  - Export markets expand niches to larger market
DISADVANTAGES OF BLENDS
REGIONAL STYLES AND TERROIR

- Unique Aroma and Flavor Identities
  - Hard to establish brand identity from unknown status
  - Must educate consumers to unique characters
- Lack of definition of local vineyard terroir effects
  - May take decades
- Lack of experience in blending regional styles
  - May take years of experimentation to develop unique wines
- May take years of marketing feedback to match wines to consumer niches
KEYS TO NICHE SUCCESS
ARE QUALITY AND CONSISTENCY

- **Product and Image Must Coordinate with Niche Strategy**
- **Unique Aroma and Flavor Identities Equate with Quality**
  - Must show high quality fruit and winemaking sensory characteristics
  - Must educate winemakers to sensory quality definitions
  - Must educate consumers to sensory quality definitions
- **Equate Vineyard and Regional Terroir with High Quality**
  - Rootstock, cultivar, canopy, and pest management for optimal quality operation
TAKE HOME LESSONS
REGIONAL WINES

- Create and exploit unique, high quality, valuable wine niches, both here and to export
- Unique wine niches express our grapes, climate, history, and cuisine
- Terroir, regional definitions, and blending skills take time and experimentation to perfect niches
- Unique wines need highly effective marketing
- Without unique regional wines, growth potential is limited by excessive competition
GC/MS Profiling of Five Colorado Cultivars

Stephen Menke and Julie Weinke
Colorado State University-WCRC
Colorado Winegrowing

- Colorado industry → 100 small wineries
  - Based primarily on arid, less cold Western Slope sites with *vinifera* varieties and *Phylloxera* free
  - Untimely or severe cold events major factor
  - High altitude: 4300-7800 feet
  - Many sites with continental climate available for hybrids, but only few sites utilized
  - Medium length season with warm post-veraison rush to harvest
Colorado Questions

- Why does Colorado *vinifera* wine taste like it has a hole in the middle palate?

- Does Colorado hybrid wine offer blending solutions?

- Sensory questions demand sensory answers
Colorado Questions

- Possible causes to investigate
  - Traditional horticultural management options
  - Unique climate/altitude factors
  - Soil factors
- Answers must include sensory knowledge
  - No sensory literature on unique Colorado conditions
  - Basic sensory profiles useful starting point
Project Parameters

- Limited funds and time
  - Basic explorations → collect broad profiles and then select areas of interest
    - Begin with broad, well-defined targets = cultivars
  - Select local cultivars that are relatively unstudied but useful
  - Use cheap and versatile equipment
  - Use minimal but dependable labor
Profile Definition

- **Dictionary**
  - a verbal, arithmetical, or graphic analysis of a process or relationship
  - a concise biographical sketch

- **Wine Profile**
  - Profile includes both volatiles and non-volatiles
  - The unique temporal display of biochemically determined attributes of a wine, including any meaning given by presentation to the human sensory apparatus
Profile Uses

- **Wine Identification**
  - Cultivar
  - Terroir
  - Sensory attributes

- **Sensory tool for winemaker /blender**
  - Knowledge of chemicals and ratios can give understanding of chemical interactions as related to sensory profile
  - sensory style of wine more accurate and consistent
Many Profiling Tools

- Comprehensive reduction/integration strategy
  - Reductive chemical analysis
    - Chromatographic separations
    - Spectroscopic identification
  - Molecular genetic analysis
    - Biological meaning of chemicals
  - Sensory analysis
    - Psychological meaning
- Correlation of chemical, genetic, and sensory will give unique meanings
Chemical Analysis Limitations

- Specific fractionation by headspace, total aromatics, phenolics, elemental, etc
  - Data within fractionation limits easier to compare
  - Studies very diverse, harder to integrate, expensive equipment

- Broad analysis
  - Total composition data is dense $\rightarrow$ harder to separate and identify data points and data gives confusing array of potential directions
  - Gross differences easier to spot and exploit by stretching area of interest
Potential Sensory Limitations

- Human apparatus $\rightarrow$ very sensitive and integrated detection
- Sensory panels’ lexicon translates well to consumer attributes
- Psychological variables difficult to decipher
- Sensory panels expensive over long haul
- Sensory panels correlation with chemical data difficult
Experimental Plan

- GC/MS → dependable, versatile first step
  - Direct injection of whole wine → broad snapshot
    - Rkatsiteli, Chambourcin, Noiret, Corot noir, Traminette
      - un-fined, un-oaked, un-filtered, single vintage per cultivar
    - RTX-wax 30 m x 0.25 mm id x 0.25 um film, w/guard
  - EID and Chemstation software
  - Spike w/pure standard wine chemicals
  - Calibrate RI against n-alkanes (C7 to C26)
Future Experiments

- GC/O and QDA panels on same samples
  - Samples from one vintage w/temperature, yeast, skin contact, horticultural, aging differences

- Expand profiles to include traditional varieties and blends

- Cooperative investigations to complete and integrate profiles for various terroir conditions

- NE-1020 members and any others
A=Ethanol, B=1-Pentanol, C=Acetic Acid, D=2,3-Butanediol, E=Propylene Glycol, F=Phenylethyl Alcohol, G=4-Ethylguaiacol, H=Glycerin, I=4-Hydroxyphenethyl Alcohol

1* = 2-methyl-1-butanol, 2* = 2,4-hexadien-1-ol, 3* = 3-methoxy-2,4,6-trimethyl-phenol, 4* = 2,3-dihydro-3,5-dihydroxy-6-methyl-4H-pyran-4-one
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1# = furanmethanol, 2# = 3-(methylthio)-1-propanol, 3# =2(5H)-Furanone, 4# = 1-(2-furanmethyl)-1H-pyrrole
Initial Aroma Chemicals for Profiles

- GC/MS gives identification
  - but not quantity or smell intensity
- Some aroma chemicals unidentified
  - May be very potent in tiny amounts
- Some aromas common to all wines
  - Different ratios of amount and smell intensity
- GC-O could give real time correlation
  - Identification and intensity
- Sensory Panels best for correlating profile
Initial Aroma Chemicals for Rkatsiteli

- alcohol, acetic acid, fruity, earthy fruity, rose, floral rose, dried rose flower, rose water, musty floral, wine-like, waxy, creamy, buttery, caramel, almond, whiskey, cognac, brandy, burnt, fusel, ether, fishy, ammonia, disagreeable, chocolate, apple, apricot, cranberry, grape, peach, pear, banana, cooked apple, pineapple
Initial Aroma Chemicals for Chambourcin

- alcohol, acetic acid, fruity, earthy fruity, rose, floral rose, dried rose flower, rose water, musty floral, wine-like, waxy, creamy, buttery, caramel, whiskey, burnt, fusel, smoky, phenolic, benzene-like, chocolate, apple, apricot, cranberry, grape, peach, pear, strawberry, banana, cooked apple
Initial Aroma Chemicals for Traminette

- alcohol, acetic acid, fruity, earthy, fruity, rose, floral rose, dried rose flower, rose water, musty floral, wine-like, waxy, creamy, buttery, oily, fatty, whiskey, cognac, brandy, burnt, fusel, smoky, phenolic, benzene-like, musty, goat, cheesy, almond, clove, spicy, chocolate, apple, apricot, cranberry, grape, peach, pear, strawberry, banana, cooked apple, pineapple
Initial Aroma Chemicals for Noiret

- alcohol, acetic acid, fruity, earthy fruity, rose, floral rose, dried rose flower, rose water, musty floral, wine-like, waxy, burnt, chrysanthemum, fusel, benzene-like, caramel, nutty, meaty, chocolate, apple, apricot, cranberry, grape, peach, pear, cooked apple
Initial Aroma Chemicals for Corot noir

- alcohol, acetic acid, fruity, earthy fruity, rose, floral rose, dried rose flower, rose water, musty floral, wine-like, waxy, creamy, buttery, fusel, smoky, phenolic, ether, amine-like, nutty, meaty, chocolate, apple, apricot, cranberry, grape, peach, pear, cooked apple
Acknowledgements

- Julie Weinke for GC/MS analysis
- Horst Caspari, Serena Norsworthy for help in winemaking

Funding
- Colorado State University
- Colorado Wine Industry Development Board
- Colorado Association for Viticulture & Enology