



Making, Blending, and Selling Wines

From Cold Hardy Cultivars

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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>
- 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
 - Alpenglöw, 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 w/higher °Brix
 - May need to limit skin contact and/or vint at below 20 °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 $< \text{pH } 3.6$, can seed with tartrate to precipitate bitartrate
 - If $> \text{pH } 3.6$, 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 cultibvars 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
 - Lallemend 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_2S 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





WINEGRAPE INDUSTRY COLORADO

- 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 → 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 → unlimited potential volume → pervasive market penetration possible
 - Vineyard sites near market population → 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* varieties in better parts of cool region
 - Unusual *vinifera* varieties 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 → scarcity → 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 w/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 w/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

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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 → 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 → 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)





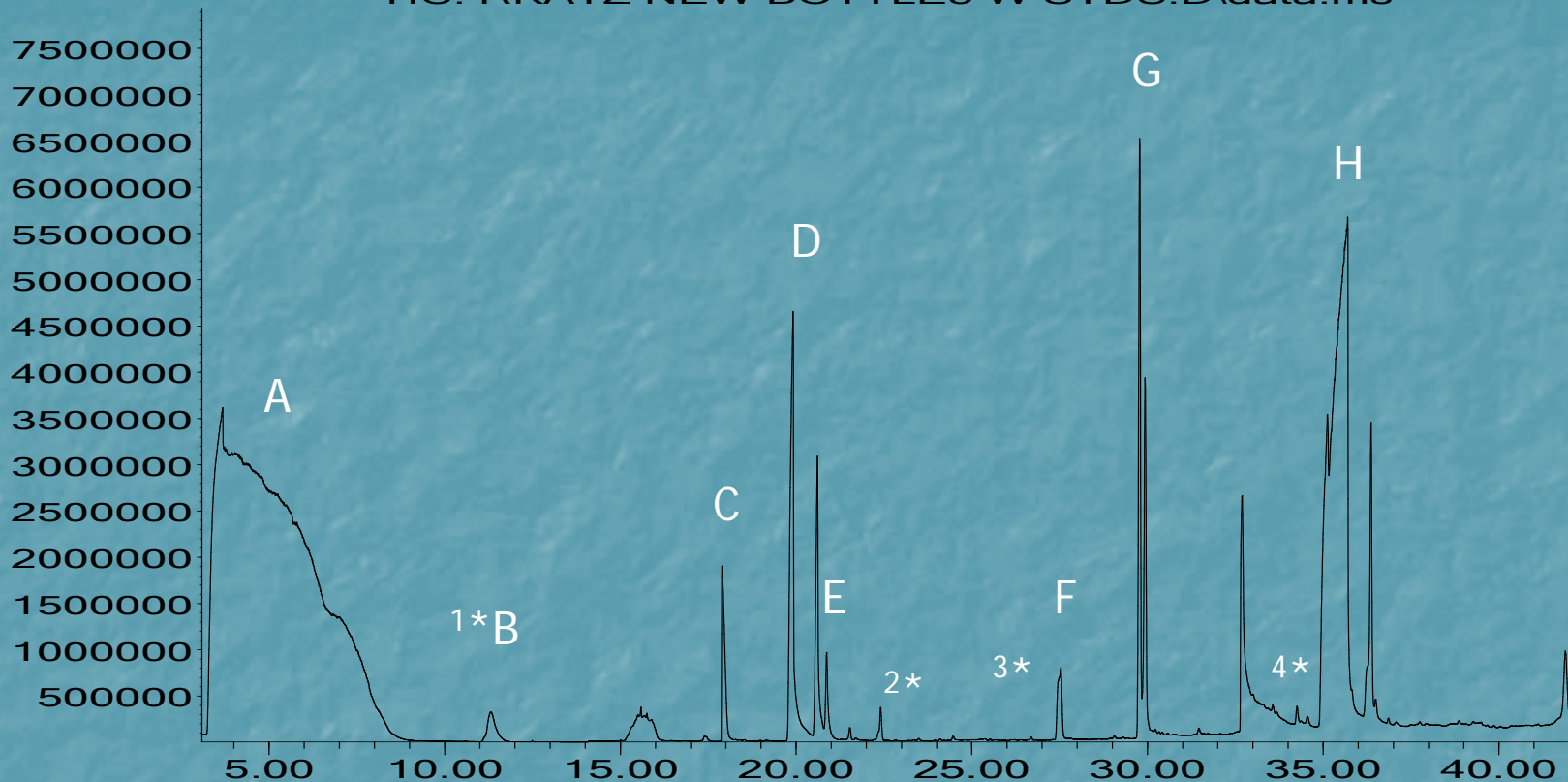
Future Experiments

- 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



Abundance

TIC: RKATZ NEW BOTTLE3 W STDS.D\data.ms



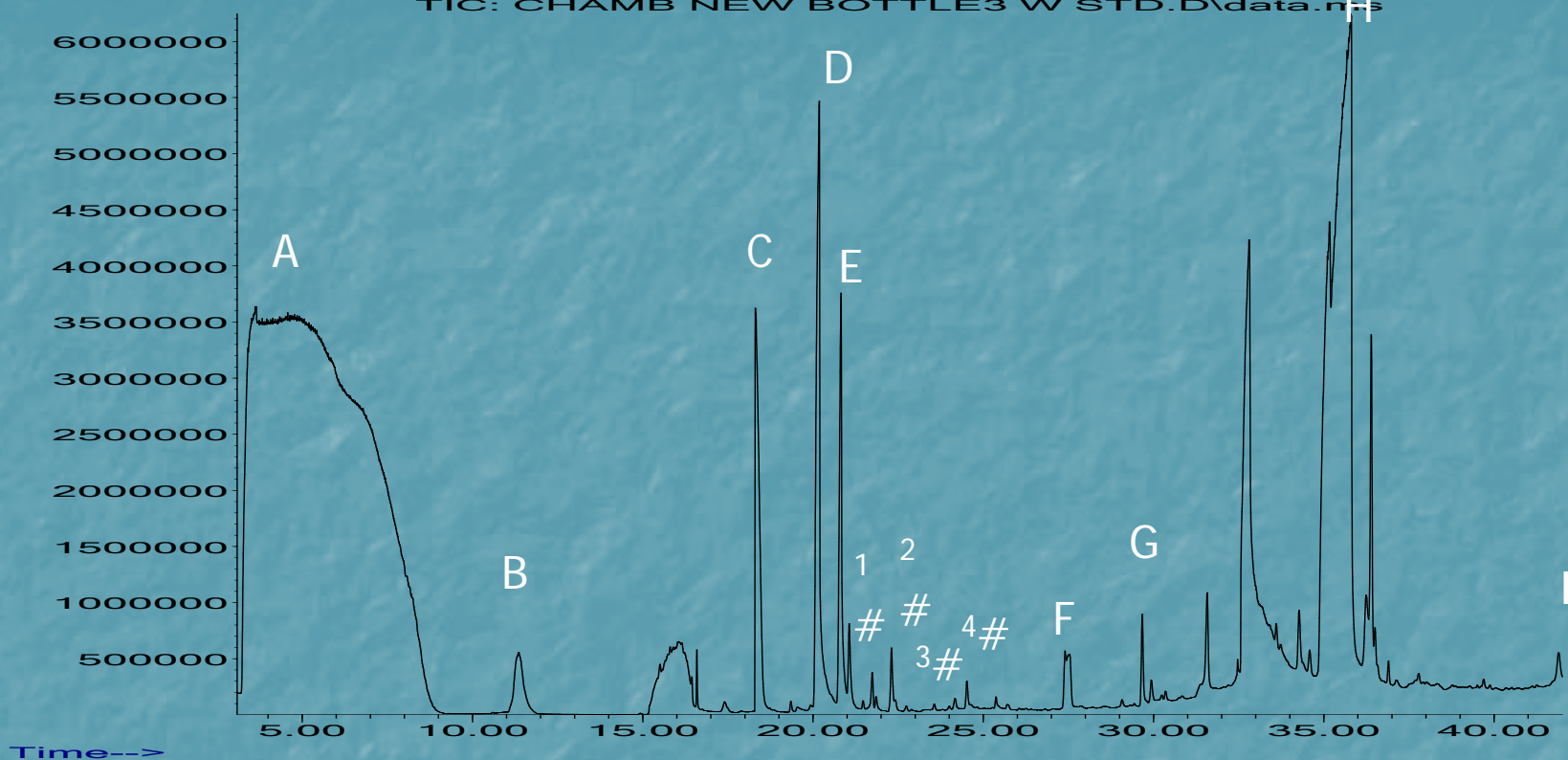
Time-->

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

Abundance

TIC: CHAMB NEW BOTTLE3 W STD.D\data.ms



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# = 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, goaty, 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

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