

UNIVERSITY OF
MARYLAND

EXTENSION

Solutions in your community

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Fruit Wine Chemistry, Processing and Fermentation

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Fruit Wine Chemistry and Fermentation



Marketing Benefits



Market Health Benefits

Red/Black Raspberry Components



Cultivar	ORAC ¹	Ellagic ¹ Acid mg/g	Vitamin ²			Fiber ² Total Dietary
			A	C	E	
Black						
Bristol	303-364	0.52	50	10	14	43
Jewel	415-451	0.39	70	10	10	38
Red						
Caroline	213	0.30	380	152	18	28
Heritage	53-90	---	280	115	15	27

¹Brunswick Laboratory – 2001

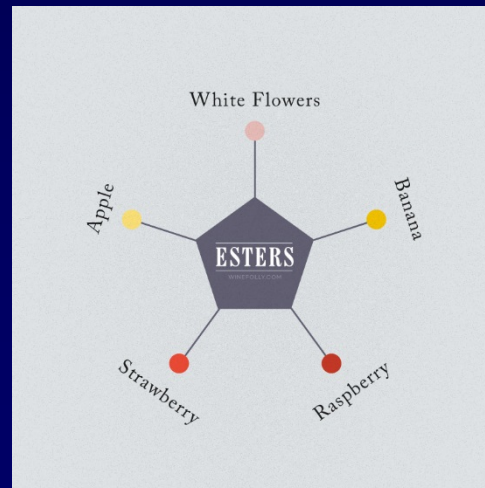
²Covance Laboratory – 2001

General Benefits

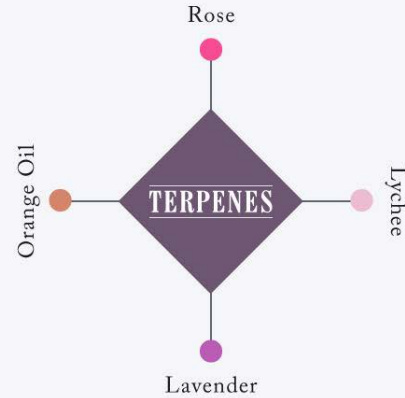
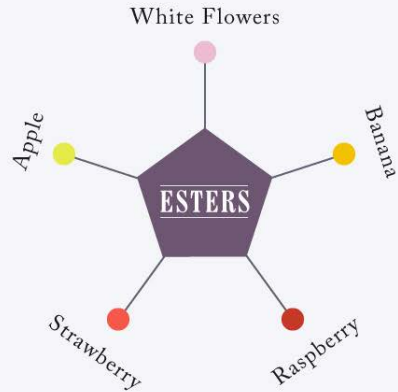
- Varietal Character
 - true to type
- Availability
 - year round
 - Frozen
 - Utilize tank space
- Quick turn around
 - Fruit to bottle
- Very Popular
 - Diversify portfolio
 - Add sweet/dessert



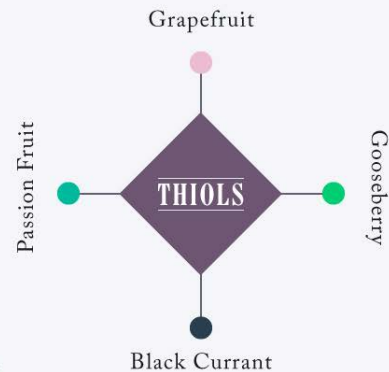
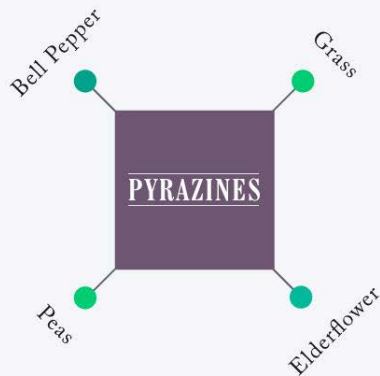
Chronicle / Craig Lee



Marketing Benefits



FRUIT • FLOWER • HERB



General Comments

- High Acid
 - Need to ameliorate
 - Balance with sugar
- Types of acids – malic, citric
 - Stability considerations
 - Malic, citric
 - MLF; sorbate
 - Ellagic acid



General Comments

- High Acid
 - Need to ameliorate
 - Balance with sugar
- Types of acids –
 - primarily citric
 - little malic
- Stability considerations
 - sorbate

General Comments

- Types
 - sweet
 - balance acid with sugar
 - dry
 - Difficult balance
 - “ice” and fortified
 - sparkling

Fruit Organic Acids: Primary and Secondary Tree Fruit

	Primary	Secondary
Apple	Malic	Quinnic
Pear	Malic	Citric, =Malic
Peach	Malic	Citric, =Malic
Cherry	Malic	Citric, Quinnic, Shikimic
Plum	Malic	Quinnic, Shikimic
Grape	Tartaric	=Malic, Citric

Fruit Organic Acids: Primary and Secondary Berries

	Primary	Secondary
Raspberry	Citric	Malic
Blackberry	Citric	Malic
Strawberry	Citric	Malic, Quinnic, Succinic
Red Currant	Citric	Malic, Oxalic, Succinic
Black Currant	Citric	Malic, Citric
Gooseberry	Citric	Malic, Shikimic

Fruit Organic Acids: Primary and Secondary Conc. Tree Fruits

	Malic	Secondary
Apple	3-19*	
Pear	1-2	Citric (=Malic)
Peach	4	Citric (=Malic)
Cherry	5-9	
Plum	6-11	Malic, Shikimic
Grape	1.5-2	Tartaric (=Malic)

*milliequivalents per 100g fresh weight

Fruit Organic Acids: Primary and Secondary Conc. Berries

	Citric	Malic
Raspberry	24*	1
Strawberry	10-18	1-3
Red Currant	21-28	2-4
Black Currant	43	6
Gooseberry	11-14	10-13

*milliequivalents per 100g fresh weight

Fruit Organic Acids: Relative Concentrations

	Apple	Pear	Strawberry	Grape
Malic	++	++	+	++
Tartaric				++
Citric	+	+	+++	+
Caffeic	+			+
Chlorogenic	+	+		+
Quinnic	+	+	+	+
Succinic	+	+	+	+
Oxalic	+			+

Apple



Brix: 11-18%

Acid:

TA: 0.5-075

type: Malic

Comments: Still; hard cider
sparkling
dry, sweet, ice

Pear



Brix: 9-11%

Acid:

TA: 0.2-0.3

type: malic

Comments: low acid!
dry, sweet, ice

Peach



Brix: 8-10%

Acid:

TA: 0.5 - 0.7

type: malic

Amelioration: 30%

Comments: Pits; clarity

Nectarine



Brix: 6-11% (10.5%)

Acid:

TA: 1.0-1.4 (1.05)

type: malic

Amelioration: 30%

Comments: Pits; clarity

Cherry



Brix: 8-13% (13%)

Acid:

TA: 1.45-1.75

type: malic

Amelioration: 25-30%

Comments: Montmorency sour

Plum



Brix:	8-13% (13%)
Acid:	
TA:	1.5-2.0
type:	Malic (shikimic, quinnic)
Amelioration:	25-30%
Comments:	Many types

Blueberry



Brix: 7-11%

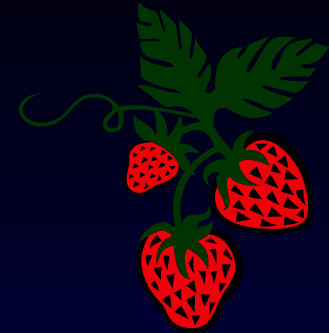
Acid:

TA: 0.3-1.55

type: citric

Comments: Cultivars;
Types or “species”
Clove spice

Strawberry



Brix: 5-9%

Acid:

TA: 1.0-1.2

type: citric

Comments: Color hue
Color stability

Raspberry - Red



Brix: 4-11% (10%)

Acid:

TA: 1.3-2.8 (1.45)

type: citric

Amelioration: 30-35%

Comments:

Varieties;

VG fruit character

Stable color



Raspberry - Black

Brix:	4-11% (10.7%)
Acid:	
TA:	0.9-2.0 (0.9)
type:	citric
Amelioration:	35-40%
Comments:	VG fruit character;

Blackberry



Brix: 4-9% (8-8.8%)

Acid:

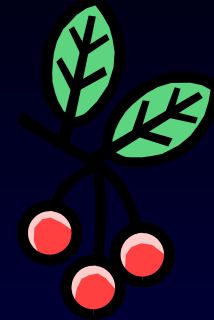
TA: 1.0-1.5

type: citric

Amelioration: 35-40%

Comments: Varieties; species
Ellagic acid precip

Cranberry



Brix: 3-5%

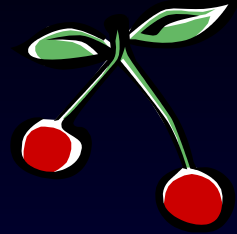
Acid:

TA: 1.2-2.0 (2.7 pH)

type: citric

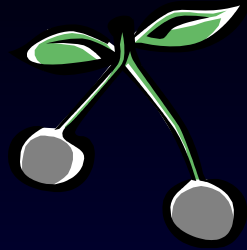
Comments: high acid; very low pH
Fermentation problems

Current - Red



Brix:	4-6%
Acid:	
TA:	2.3-2.7
type:	citric
Comments:	uncommon

Current – Black



Brix: 5-8%

Acid:

TA: 2.3-3.1

type: citric

Comments: Great color
True to type



Gooseberry

Brix:	4-6%
Acid:	
TA:	1.8-2.2
type:	malic
Comments:	uncommon

Fruit Wine Chemistry and Fermentation

General Fermentation

- Varietal Character
 - true to type
- Defrost
 - no destem and crush
- Ferment
 - Cold; maintain fruit
- Press/drain



Factors affecting Fermentation Management - Key Interrelationships

JUICE or MUST

TEMPERATURE

YEAST STRAIN

CELL
NUMBERS

NUTRITIONAL
FACTORS

TOXIC
FACTORS

COMPETITIVE
FACTORS

**MAXIMUM
FERMENTATION
MANAGEMENT**



Fruit Wine Chemistry and Fermentation

2001: An Enological Odyssey

Combining Old World Wisdom with New World Technology



LALVIN
Enococcus oeni
MBR process
pour 25 hl
for 660 gals
25. e

31
Sélectionnée par
ITV France et LALLEMAND
produit par / produced by
LALLEMAND S.A.
St. Sulpice - France

4°C 12 mois
40°F 12 months
-18°C 18 mois
0°F 18 months

MICROE
MBR B1N
process
Bactéries lactiques (Enococcus oeni)

O S
Dose pour
25 hL

LAFFORT
ENOLOGIE

4°C 12 mois
40°F 12 months
-18°C 18 mois
0°F 18 months

LOT 771410505

LOT 769480503



Yeast Strains

- **EC1118 – good general; low pH**
- **71B – good overall; Malic**
- **BA11 – good fruit character; mouth feel**
- **K1 – Tree/White fruits**
- **R2 – high sugars; low temps; Ice wines**
- **VIN13 – high alcohol**

Finishing

- **Sweeten to balance**
- **Bentonite fining**
 - **heat stabilize**
 - **protein haze**
- **SO₂**
- **Sorbate**
- **Cold stabilize?**
- **Sterile filter**

Ellagic Acid

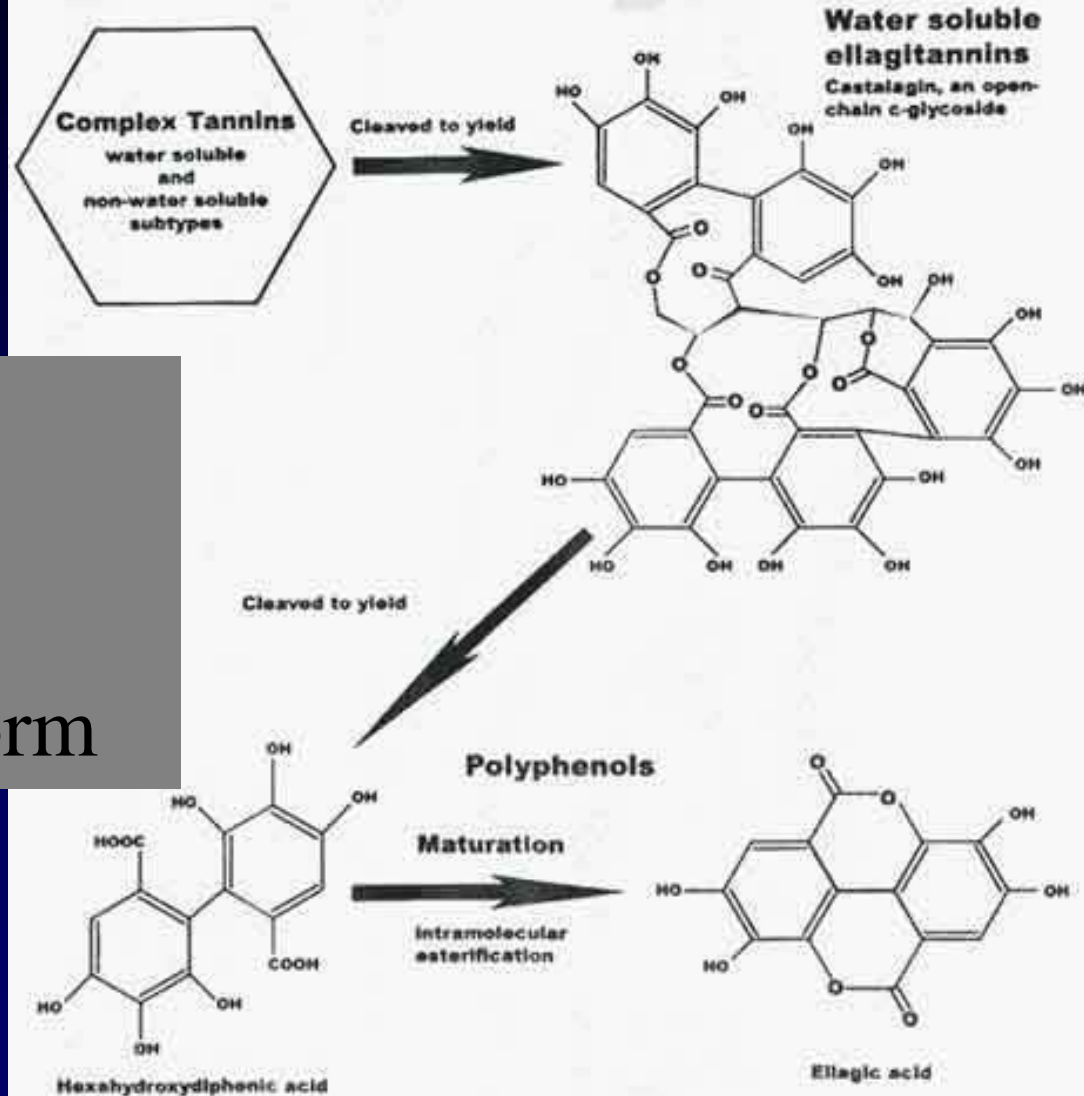
- High Concentration in Brambles
- Phenol
- Extremely potent anti-carcinogen
- Mostly in seeds; some in pulp
- Problem with precipitation in wine

Ellagic Acid

- High Concentration in Brambles
- Phenol
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- Mostly in seeds; some in pulp
- Problem with precipitation in wine

Schematic 1: Metabolic Pathways of the Water Soluble Ellagitannins
(Note that enzymes in the digestive system cleave complex tannins to yield ellagic acid.)

www.ellagic.net



Goes from bound-soluble form to unbound in-soluble form

Managing Ellagic Acid

<u>Cultivar</u>	<u>1997^z</u>		<u>1998^y</u>	
	<u>Pulp</u>	<u>Seed</u>	<u>Pulp</u>	<u>Seed</u>
Caroline	36	173	53 a	799 a
A. Bliss	22	99	42 b	264 c
Heritage	41	106	39 b	467 b
Anne ^x	11	178	8	61
Ruby	40	176	10	86

Managing Ellagic Acid

	Ripe ^{1,2}		<u>Unripe</u>	
<u>Cultivar</u>	<u>Pulp</u>	<u>Seed</u>	<u>Pulp</u>	<u>Seed</u>
Navaho	24	352	37	214
Hull	17	347	34	309
Chester	22	325	35	299

Managing Ellagic Acid

- Monitor source
 - Variety; season; area; ripeness
 - You test or ask for test (organic acid)
 - Ripe more in seed
 - Under-ripe – more in pulp
 - Fresh vs. concentrate
 - more pulp – less seed?
 - Hot pressed/extracted?
- Raise temperature – effect on quality?
- Wait to precipitate
 - 6-12 months for natural precipitation
 - Add tannin
 - Old oak barrels

Other “Fruit” Wines

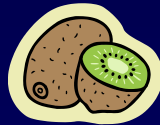
- Elderberry



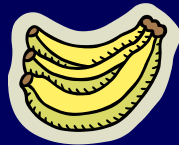
- Pineapple



- Kiwi



- Banana



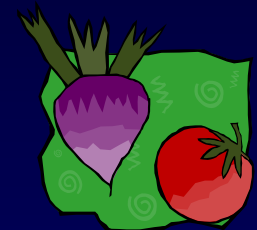
- Orange



- Watermelon



- Rhubarb



- Tomato

- Garlic

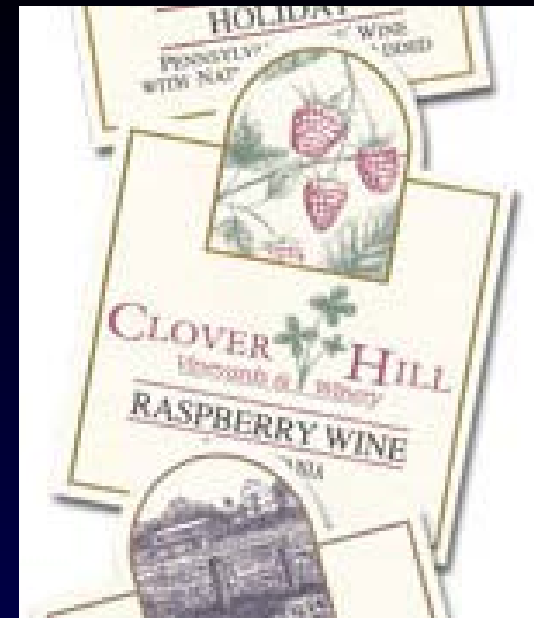


- Dandelion



Fruit Wine Chemistry and Fermentation

BERRYWINE
PLANTATIONS, INC.
LANGANORE
WINECELLARS





Always
consume in
moderation!

Enough Talking...

Let's Taste

Some Wines!!!!

Enjoy!

Fruit Wine Chemistry and Fermentation



Always consume responsibly
and in moderation!!!

“Wine makes daily living easier,
less hurried, with fewer tensions,
and more tolerance.”

--Benjamin Franklin

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