



GREENNESS IN WINE

TOOLS FOR CREATING HARMONIOUS PALETTES IN COLD-CLIMATE WINES



WHAT IS GREENNESS?

- GENERALLY REFERRING TO A CLASS OF COMPOUNDS CALLED METHOXPYRIZINES
 - ISOBUTYLMETHOXPYRAZINE (IBMP)
 - IPMP, SBMP
- PROMINENT IN SOME VARIETALS
 - SAUVIGNON BLANC
 - CABERNET FRANC
 - CABERNET SAUVIGNON



OTHER GREEN CHARACTERS

CUT LEAF VOLATILES (C6 ALCOHOLS)

HEXANOL, HEXANAL

DESCRIBED AS GRASSY, HERBACEOUS, LEAFY



OTHER GREEN CHARACTERS

- SULFUR COMPOUNDS
 - DMS, DES, DMDS...
- NOT GENERALLY WHAT WE TALK ABOUT WHEN WE CONSIDER "GREEN FAULTS"
 - REDUCTION FAULTS



OTHER GREEN CHARACTERS

- MULTI-COLORED ASIAN LADY BEETLE
- RELEASES METHOXYPYRAZINE WHEN STRESSED

OTHER GREEN CHARACTERS

- VOLATILE THIOLS ARE SOMETIMES DESCRIBED AS HAVING A BOXWOOD OR CAT URINE AROMA
- GENERALLY CONSIDERED DESIRABLE FOR CERTAIN VARIETALS
 - SAUVIGNON BLANC



OTHER GREEN CHARACTERS

- GRAPE SKINS HAVE THE ABILITY TO ADSORB THE VOLATILE AROMAS OF NEARBY PLANTS
 - PINE
 - EUCALYPTUS
 - "GARRIGUE"
 - MEDITERRANEAN PLANTS





GREEN TANNINS?

- WHEN DESCRIBING TANNINS AS “GREEN” WE ARE GENERALLY REFERRING TO BITTERNESS AND ASTRINGENCY ASSOCIATED WITH UNDERRIPE FRUIT
- BITTER/ASTRINGENT TANNINS GENERALLY COINCIDE WITH OTHER GREEN FLAVORS

COMPLICATIONS IN HYBRID GRAPES...

- ORIGIN OF “GREEN” CHARACTERS
HAVEN’T BEEN IDENTIFIED
 - ASSUMING PYRIZINES
 - VARIETAL CHARACTER?





DO WE WANT TO MINIMIZE GREENNESS IN WINE?

IT DEPENDS...



MINIMIZING UNDESIRABLE GREEN CHARACTERS IN WINE

CREATING A BALANCED PROFILE



CUT LEAF VOLATILES (C6 ALCOHOLS)

- PRECURSORS TO THESE COMPOUNDS ARE FORMED FROM UNSATURATED FATTY ACIDS AFTER DAMAGE TO GREEN TISSUE (BERRY SKIN, STEMS, LEAVES) – USUALLY DURING CRUSHING
 - CONCENTRATION DIFFERS BY VARIETY
 - CONCENTRATION DECREASES AFTER VERAISON
- TEND TO BE MORE OF A CONCERN ON WHITE VARIETALS THAT ARE PICKED EARLY TO MAINTAIN FRESHNESS





MINIMIZING THE PRESENCE OF CUT LEAF VOLATILES (C6 ALCOHOLS)

DURING WINEMAKING AND STORAGE

- PROTECT WINE WITH SO_2 (O_2 NEEDED FOR FORMATION)
- WINEMAKING PRACTICES THAT PROMOTE ESTER FORMATION
 - ALCOHOL $\rightarrow$ ACETATE ESTER
- RELATIVELY STABLE COMPOUNDS
 - SLIGHT REDUCTION WITH LEES CONTACT
 - UNAFFECTED BY STORAGE IN PRESENCE OF OXYGEN
 - UNAFFECTED BY SHORT-TERM OXIDATIVE STORAGE IN PRESENCE OF TANNINS

MINIMIZING METHOXYPIRAZINES

CURRENTLY THERE ARE TWO APPROACHES:

1. MINIMIZE THEIR EXTRACTION
 2. MASQUE THEIR FLAVOR
- CURRENT RESEARCH IS LOOKING TO THE SORPTIVE CHARACTER OF METHOXYPIRAZINES TO CERTAIN POLYMERS. ALTHOUGH PROMISING, THESE ARE NOT AVAILABLE/AUTHORIZED FOR WINE PRODUCTION



GENERAL RECOMMENDATIONS: WHITE WINEMAKING



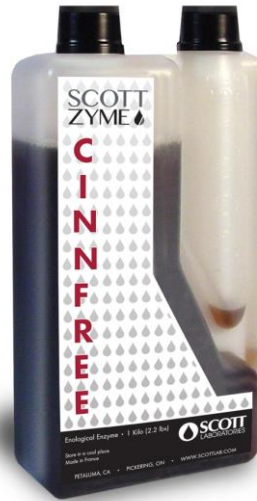
- ELIMINATE MOG (MATERIAL OTHER THAN GRAPES)
- SORT THE FRUIT AND SEPARATE TO DIFFERENT LOTS IF NECESSARY
- TREAT THE FRUIT GENTLY THROUGHOUT THE PROCESS
- ELIMINATE THE GRAPE SOLIDS QUICKLY
- AVOID USING DAP AS THAT WILL DIMINISH THE PRODUCTION OF FRUITY FLAVORS, AND CAN PROMOTE THE PRODUCTION OF VOLATILE SULFUR COMPOUNDS WHICH WILL HEIGHTEN THE GREEN FLAVORS
- WINEMAKING PRACTICES THAT PROMOTE ESTER FORMATION (YEAST SELECTION, TEMP,...)
- MANAGE ACID PROFILE
- MIX THE TANK DURING THE LATER STAGES OF FERMENTATION TO KEEP THE YEAST IN SUSPENSION



FRUIT RECEPTION AND GRAPE PROCESSING

GOAL: SECONDARY SORTING AND FAST PROCESSING

- CLARIFICATION ENZYMES HELP BREAK DOWN GRAPE PECTIN CHAINS; THIS ALLOWS YOU TO TREAT THE FRUIT GENTLER AND PRESS AT LOWER PRESSURE SO THE PYRAZINES ARE MINIMALLY EXTRACTED FROM THE SKINS.
- PROTECT JUICE FROM OXIDATION (GOOD SO₂ MANAGEMENT)



PRESSING WHITE GRAPES

- PROTECT FROM ANY OXIDATIVE DAMAGE BY PRESSING UNDER A CO₂ BLANKET (DRY ICE).
- PRESSING TO THE LOWEST PRESSURE IS CRITICAL AS 95% OF THE PYRAZINES ARE FOUND IN THE GRAPE SKINS
- CONSIDER DESTEMMING TO ELIMINATE THE RACHIS
- SEPARATE (AND POSSIBLY ELIMINATE) THE FIRST 10 GALLONS PER TON AS THE INITIAL FREE RUN JUICE WILL CONTAIN DUST AND DIRT FROM THE VINEYARDS AND IS HIGH IN VINEYARD SPRAY RESIDUES.
- TASTE YOUR PRESS CUTS; EVALUATE AND TREAT SEPARATELY IF REQUIRED

STATIC SETTLING/JUICE CLARIFICATION

GOAL: CLARIFICATION AND OXYGEN CONTROL

- USE OF NON-PROTEIN FINING AGENTS WILL ASSIST IN CLARIFICATION
 - BENTONITE, PVPP, CELLULOSE, COLD MIX SPARKALLOID

FRESH PROTECT IS A BLEND OF FINING AGENTS FORMULATED SPECIFICALLY TO GUARD AGAINST OXIDATION OF POLYPHENOLS THAT CAN LEAD TO HERBACEOUSNESS

FRESHPROTECT

VINIFICATION - CLARIFICATION

STATIC SETTLING/JUICE CLARIFICATION

GOAL: CLARIFICATION AND REMOVAL OF HARSH PHENOLICS

- IF TANNINS ARE ASTRINGENT, A GELATIN FINING AGENT IS RECOMMENDED IN THE JUICE
- FOLLOWING-UP GELATIN FINING WITH A SILICA FINING AGENT WILL ENSURE THE LEES IS COMPACT TO MINIMIZE LOSS



STATIC SETTLING/JUICE CLARIFICATION

GOAL: REMOVAL OF BITTER COMPOUNDS

- PVPP AND CASEIN FINING AGENTS ARE GOOD CHOICES
- FOLLOWING-UP GELATIN FINING WITH A SILICA FINING AGENT WILL ENSURE THE LEES IS COMPACT TO MINIMIZE LOSS

CASEINATE DE POTASSIUM

VINIFICATION - CLARIFICATION

ALCOHOLIC FERMENTATION

Fermentation should be started quickly

Yeast choice should promote fruitiness (esters)

- CrossEvolution, CVW5, Alchemy 1, Lalvin 71B, QA3, K1 (V1116)

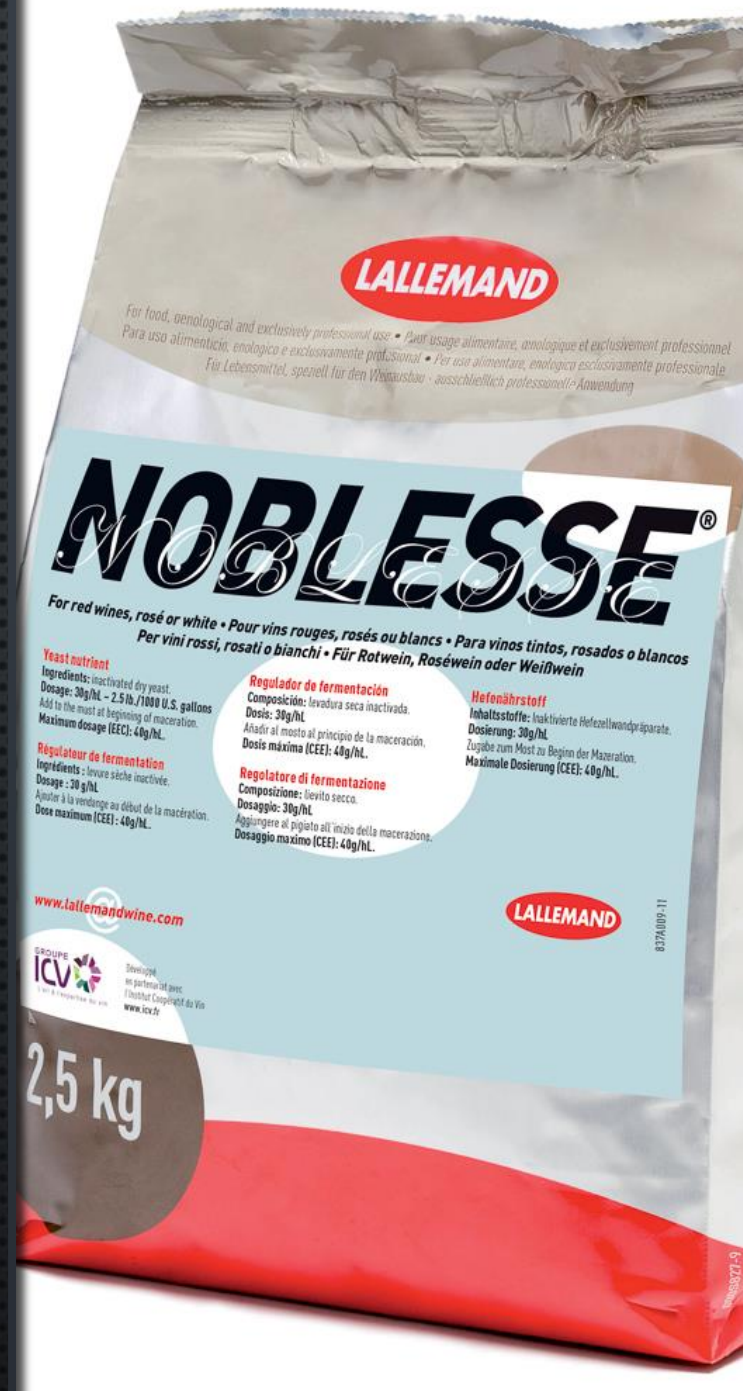
Yeast nutrient management – Organic nutrients favor ester production

- GoFerm, Fermaid O, Stimula Chardonnay

YEAST DERIVATIVES DURING FERMENTATION

- THESE ARE “CLEAN LEES” THAT CONTAIN SPECIFIC INACTIVATED YEAST FRACTIONS WITH KNOWN ACTIONS IN WINE
- PRODUCTS HIGH IN GLUTATHIONE CAN FURTHER PROTECT AGAINST OXIDATION AND PROMOTE FRUITY AROMATICS
- A 2ND ADDITION AT THE END OF FERMENTATION CAN HELP REMOVE BITTERNESS





END OF FERMENTATION

- ALLOW GROSS LEES TO SETTLE 24-48 HOURS AND RACK INTO CLEAN TANK
- IF VEGETAL CHARACTER PERSISTS ADD 10G/HL NOBLESSE (YEAST DERIVATIVE)

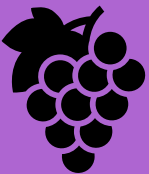


Continue to protect against Oxidation



Can trial tannin additions to further aid in preventing oxidation and building structure of wine

FT Blanc, FT Blanc Soft, FT Blanc Citrus, Scott'Tan Estate, Scott'Tan Refresh



Gelatin, Casein, and/or PVPP may be trialled to further reduce bitterness/astringency

POST-FERMENTATION AND AGING



GENERAL RECOMMENDATIONS: RED WINEMAKING

- ELIMINATE MOG (MATERIAL OTHER THAN GRAPES)
- SORT THE FRUIT AND SEPARATE TO DIFFERENT LOTS IF NECESSARY
- TREAT THE FRUIT GENTLY THROUGHOUT THE PROCESS
- DO NOT COLD SOAK
- WINEMAKING PRACTICES THAT PROMOTE ESTER FORMATION (YEAST SELECTION, TEMP,...)
- AVOID DAP
- SHORT FERMENTATION TIME, NO EXTENDED MACERATION
- WORK SENSIBLY TO ENHANCE STRUCTURE

FRUIT RECEPTION AND GRAPE PROCESSING

- BEGIN FERMENTATION AS SOON AS POSSIBLE WITH NO COLD SOAK
 - ENZYMES CAN AID IN EXTRACTION
- TANNINS SHOULD BE ADDED TO STABILIZE EARLY EXTRACTION OF COLOR
 - RESPECT 6-8 HOUR INTERVAL BETWEEN ENZYME AND TANNIN ADDITION



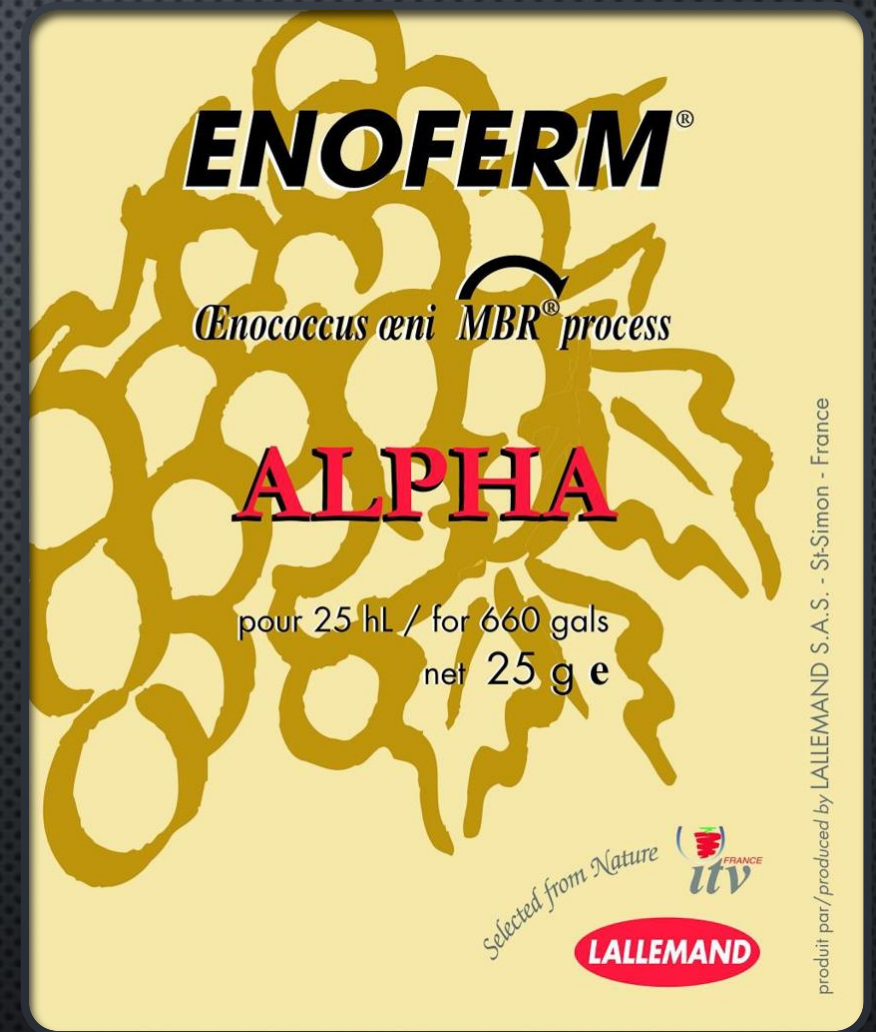
ALCOHOLIC FERMENTATION

- YOU WANT A SECURE ALCOHOLIC FERMENTATION
- USE A YEAST STRAIN THAT WILL START QUICKLY, PROMOTE GOOD FRUIT CHARACTER AND TEXTURE WHILE MINIMIZING HERBACEOUS/ VEGETATIVE FLAVORS AND STABILIZING COLOR.
 - ALCHEMY III OR IV, LALVIN GRE, ENOFERM CSM, BDX
- AT 1/3 SUGAR DEPLETION FT COLOR MAX CAN BE USED TO FURTHER INCREASE COLOR STABILITY
 - SHOULD BE USED IN CONJUNCTION WITH FT ROUGE



MALOLACTIC FERMENTATION

- CONSIDER INOCULATING 24-48 HOURS AFTER YEAST, OR AS SOON AS AF IS COMPLETE
- CHOOSE A STRAIN THAT WILL CONDUCT A RAPID MLF
- ALPHA IS KNOWN TO REDUCE VEGETATIVE CHARACTERS AND PRODUCE POLYSACCHARIDES TO ENHANCE MOUTHFEEL



POST-FERMENTATION AND AGING



Tannin trials can be conducted to further enhance structure

Scott'Tan Estate, Tannin Complexe, Tannin Refresh



fining may be necessary to further reduce astringency

Colle perle, Inocolle, Casein, polycacel, polycel

START IN THE VINEYARD

- “GREEN” FLAVORS ARE GENERALLY ASSOCIATED WITH GRAPES THAT HAVE NOT ACHIEVED A SUFFICIENT LEVEL OF RIPENESS





SOMETIMES YOU JUST NEED TO PICK EARLY

- DISEASE PRESSURE
- BERRY DAMAGE BY BIRDS, INSECTS, ANIMALS
- CURRENT AND POTENTIAL WEATHER CONDITIONS
- LOGISTICS



LALVIGNE

- VINEYARD SPRAY DEVELOPED BY LALLEMAND PLANT SCIENCE
- USEFUL IN BLOCKS WHERE RIPENESS IS ALWAYS DIFFICULT TO ACHIEVE

WHAT IS LALVIGNE?

- 100% SPECIFIC FRACTIONS OF INACTIVATED YEAST, *SACCHAROMYCES CEREVISIAE*
- NON HAZARDOUS: CLEAN, SAFE, FOOD GRADE



Recognition by the plant
receptors

Activation of the plant
response

Effect on genes involved in the synthesis of secondary
metabolites

Phenotypical differences

Improved wine quality

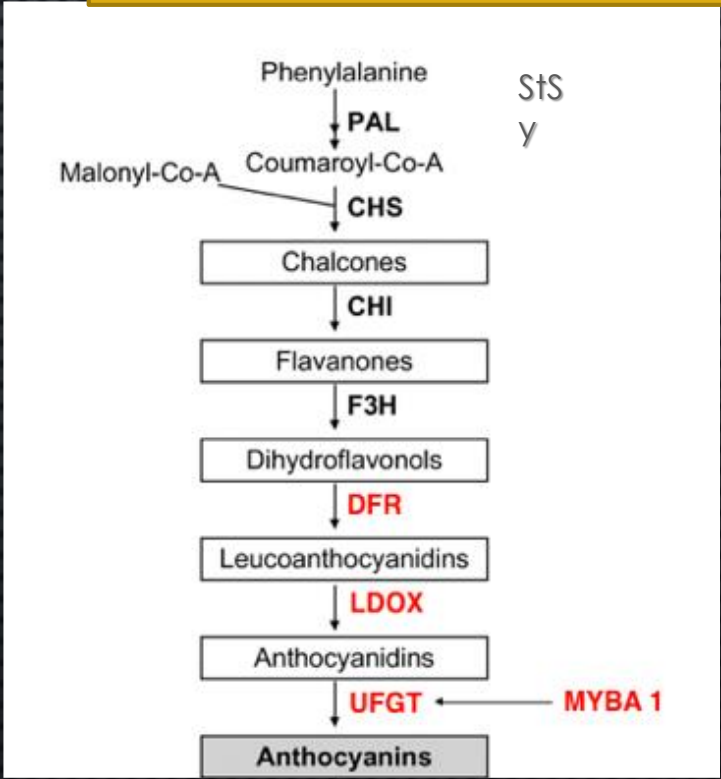


Expression of the main genes involved in the synthesis of anthocyanins in Sangiovese grapes treated with LaVigne MATURE

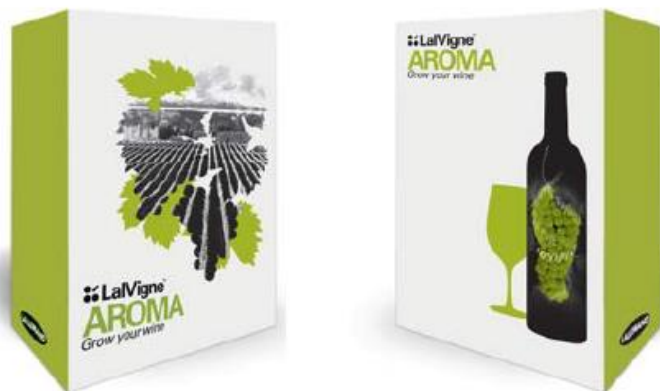


Fillipeti et al. 2017

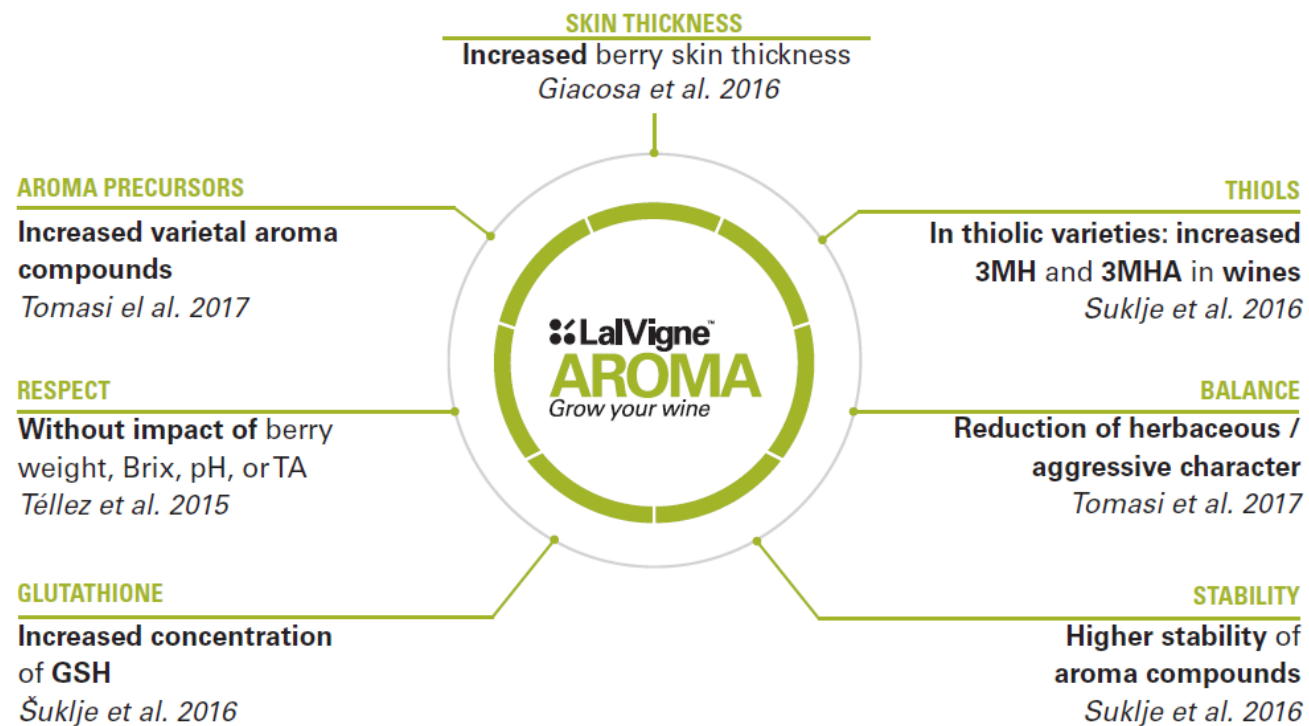
Phenylpropanoid pathway



Gene	Expression LVM /C	Stage of expression
PAL	+	Post T 2
StSys	+	Post T 2
CHS 1	+	Post T 2
CHS 2	++	Post T 1
CHI 1	+++	Post T 2
CHI 2	++	Post T 1
F3H 1	-	
F3H 2	-	
DFR	++	Post T 2
LDOX	+++	Post T 2
UFGT	+++	Post T 1
MyBA1	++	Post T 1



**Increased and advanced
accumulation of aroma
precursors**



SKIN THICKNESS

Increased berry skin thickness with higher extractability of anthocyanins

Río Segade et al. 2016

RESPECT

Without impact on berry weight, Brix, pH, TA

González et al. 2016

BALANCE

Reduction of herbaceous / aggressive character

Tomasi et al. 2017



ANTHOCYANINS

Increases concentration of extractable anthocyanins

Villangó et al. 2015

TANNIN

Increases skin tannins

Lissarrague et al. 2014

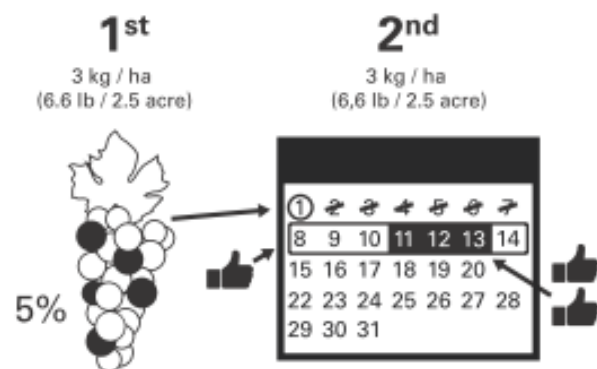
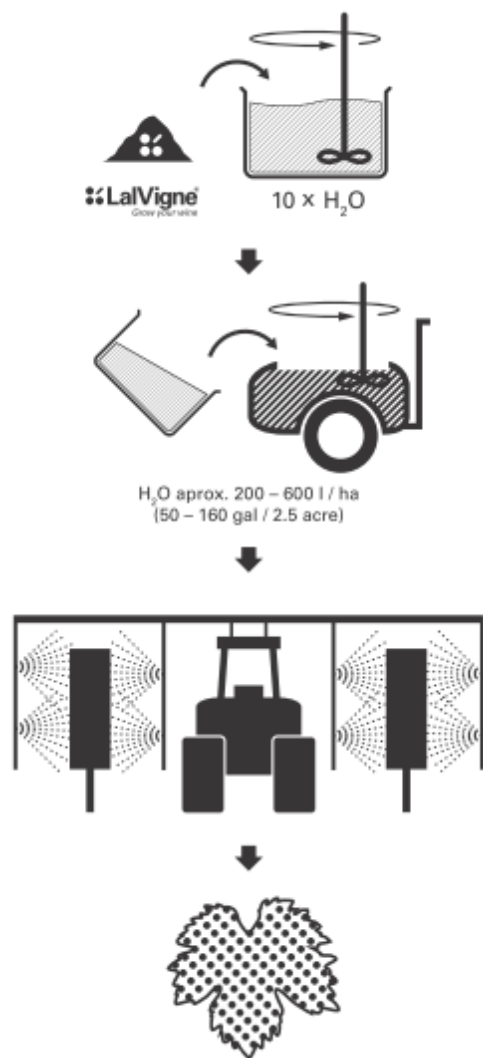
QUALITY

Increased degree of polymerization

Villangó et al. 2015



Increased and advanced phenolic maturity



LalVigne™
AROMA
Grow your wine

LalVigne™
MATURE
Grow your wine

KATIE COOK

- SCOTT LABORATORIES
- KATIEC@SCOTTLAB.COM

THANK YOU FOR YOUR TIME!

QUESTIONS?

