

Flavour development in the vineyard

To understand how to get there
you need to begin at the end.

Patrick Iland, Keren Bindon, Paul Smith, Leigh Francis,
Tracey Siebert, Paul Boss

Flavour development in the vineyard

References

The Grapevine: from the science to the practice of growing vines for wine. Patrick Iland, Peter Dry, Tony Proffitt, Steve Tyerman (Patrick Iland Wine Promotions)

www.piwpwinebooks.com.au

Papers by Keren Bindon et al. Relationships between harvest time and wine composition in *Vitis vinifera* L. cv. Cabernet Sauvignon Part 1. Grape and wine chemistry and Part 2. Wine sensory properties and consumer preference. AWRI publication in Food Chemistry Journal

The flavour of a wine

to understand how to get there
sometimes we need to begin at the end

Describing a Pinot Noir wine

Aromas of cherry, raspberry and plums, vibrant,
silky mouthfeel, long finish

The flavour of a wine

Flavour = total in-mouth experience

Aroma

Tastes

Mouthfeel

Flavour development in the vineyard

WINE

Aroma

Tastes

Mouthfeel

BERRIES

free aroma compounds
precursors

acids, sugars, salt, phenolic
compounds

Phenolic compounds
monomers — catechins
Tannins, polysaccharides, alcohol

Flavour development in the vineyard

Berry development

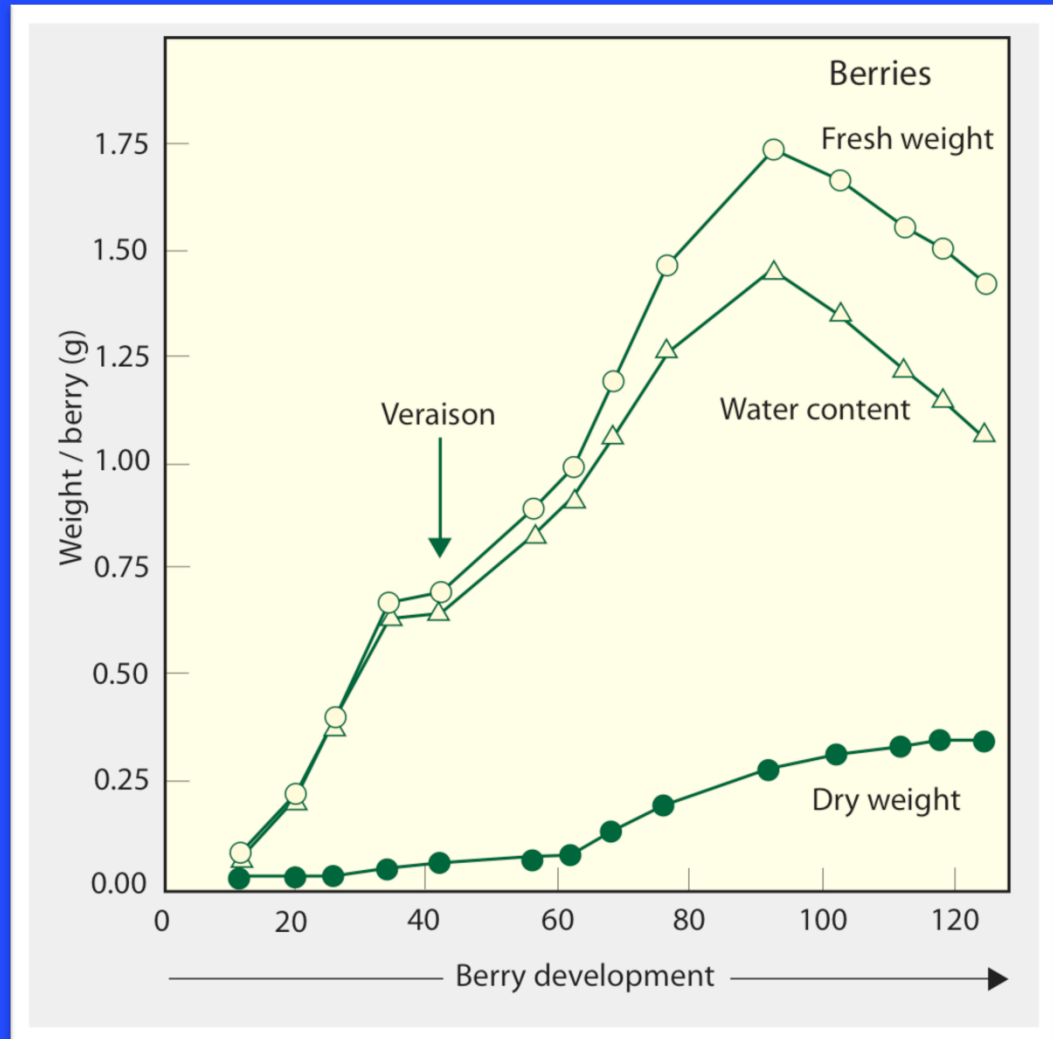
Berry set to veraison

Veraison to harvest

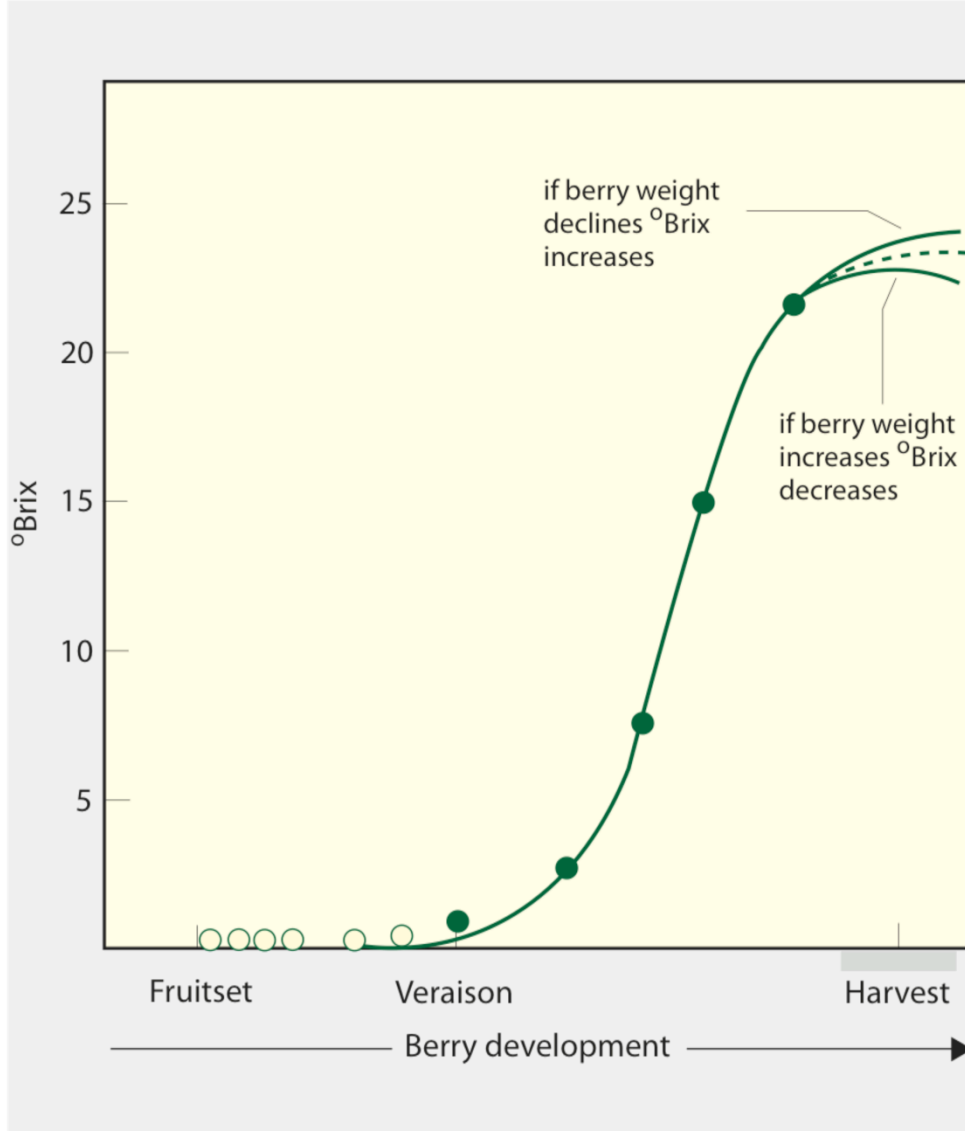
Berry ripening

Flavour development in the vineyard

Berry weight



Sugars —juice



Flavour development in the vineyard

WINE

tart
vitality
freshness
lively
crisp
vibrant

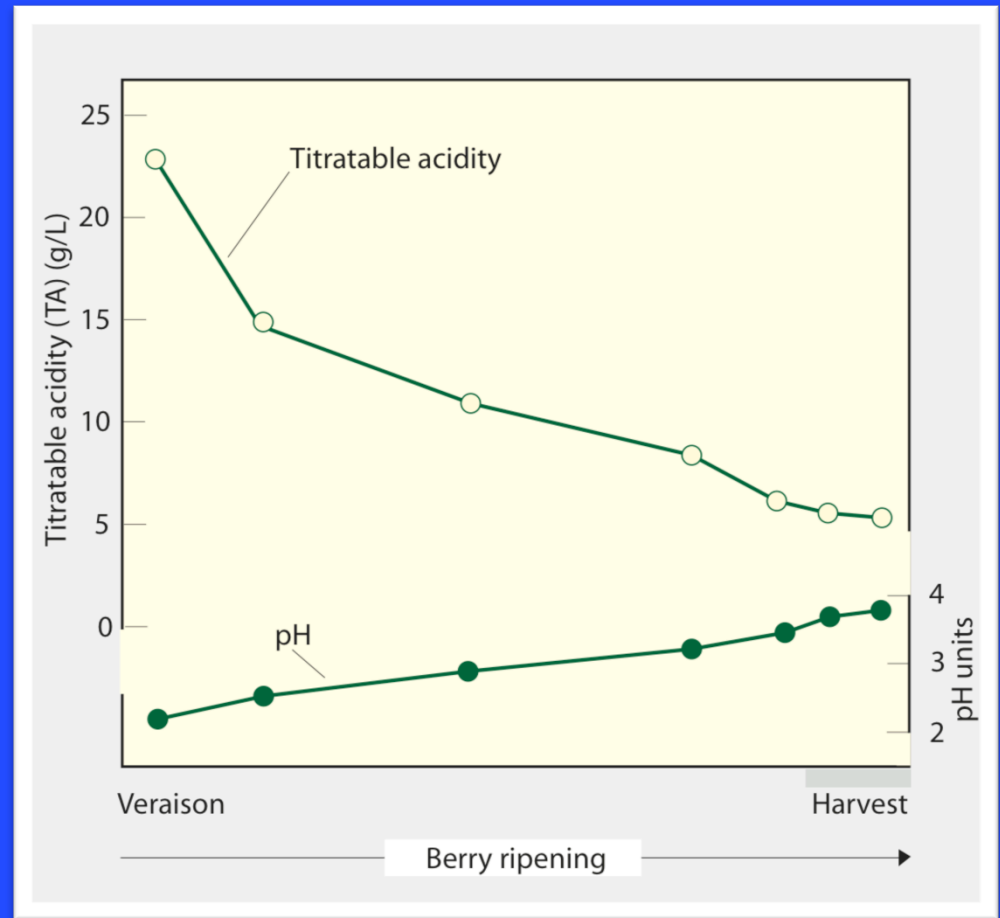
BERRIES

pH
titratable acidity
tartaric acid
malic acid
potassium
sodium

Flavour development in the vineyard

pH
titratable acidity

Juice



Flavour development in the vineyard

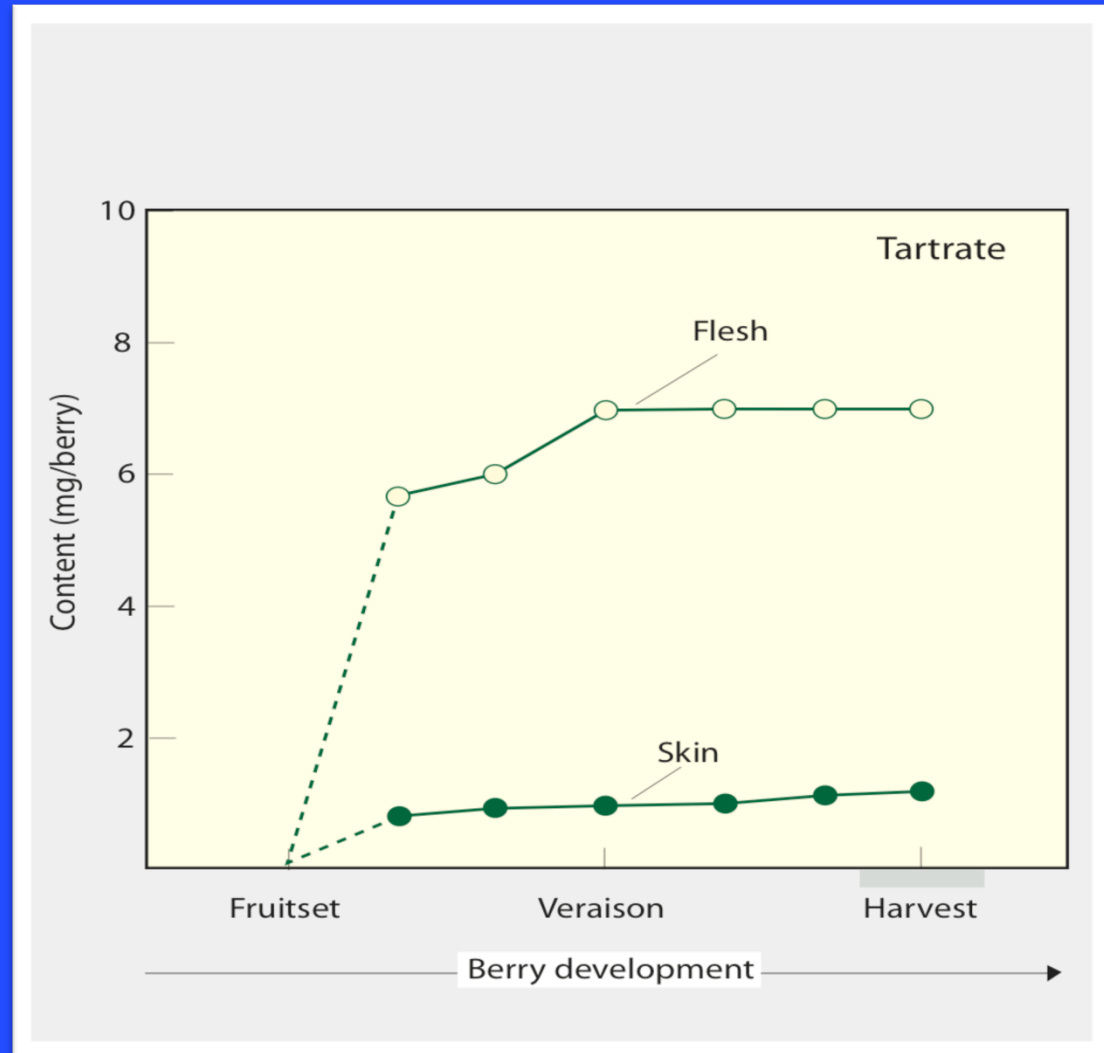
Per berry
(content)

per gram berry weight
(concentration)



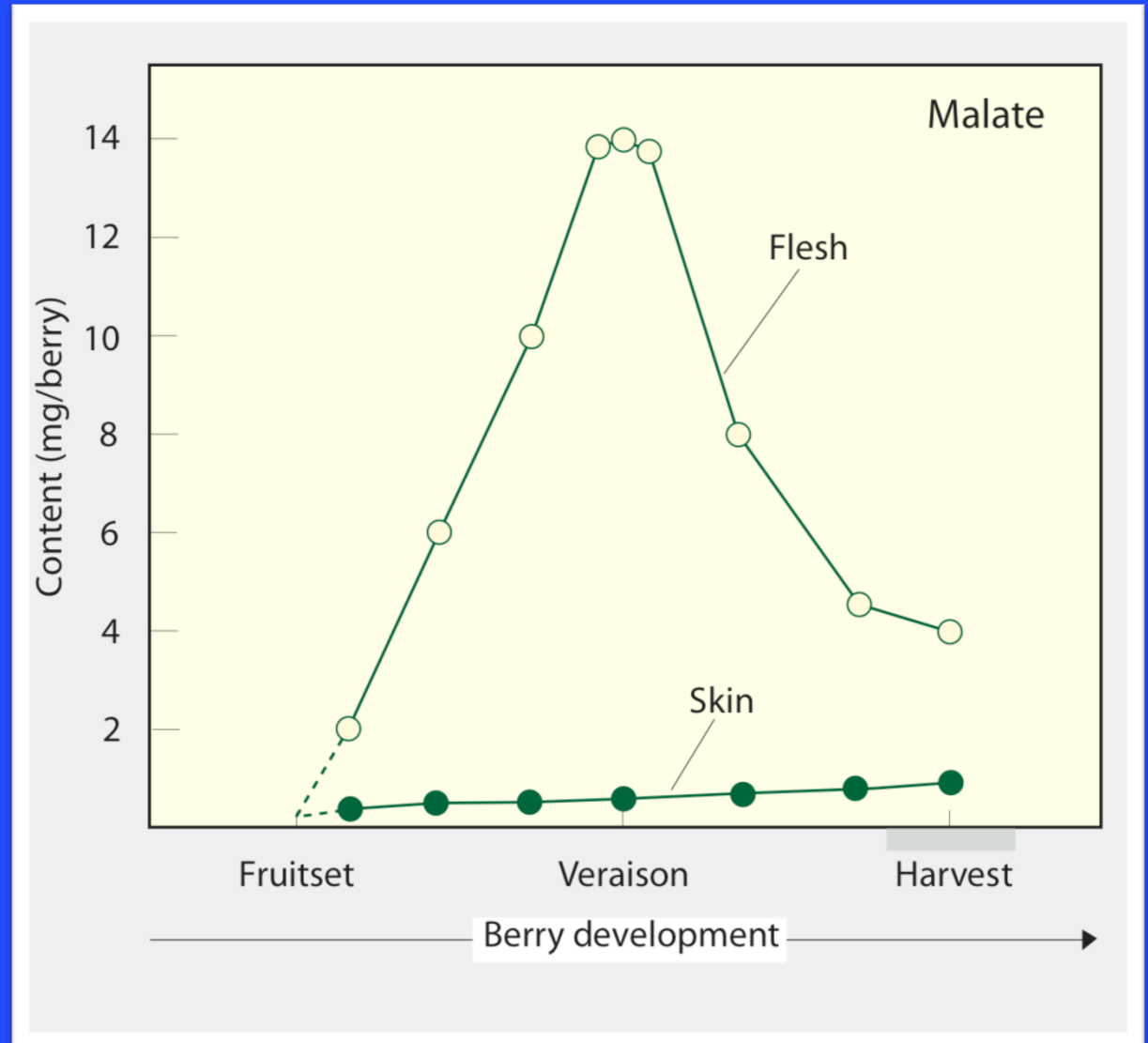
Flavour development in the vineyard

tartaric acid



Flavour development in the vineyard

malic acid



Flavour development in the vineyard

WINE

Colour

mouthfeel

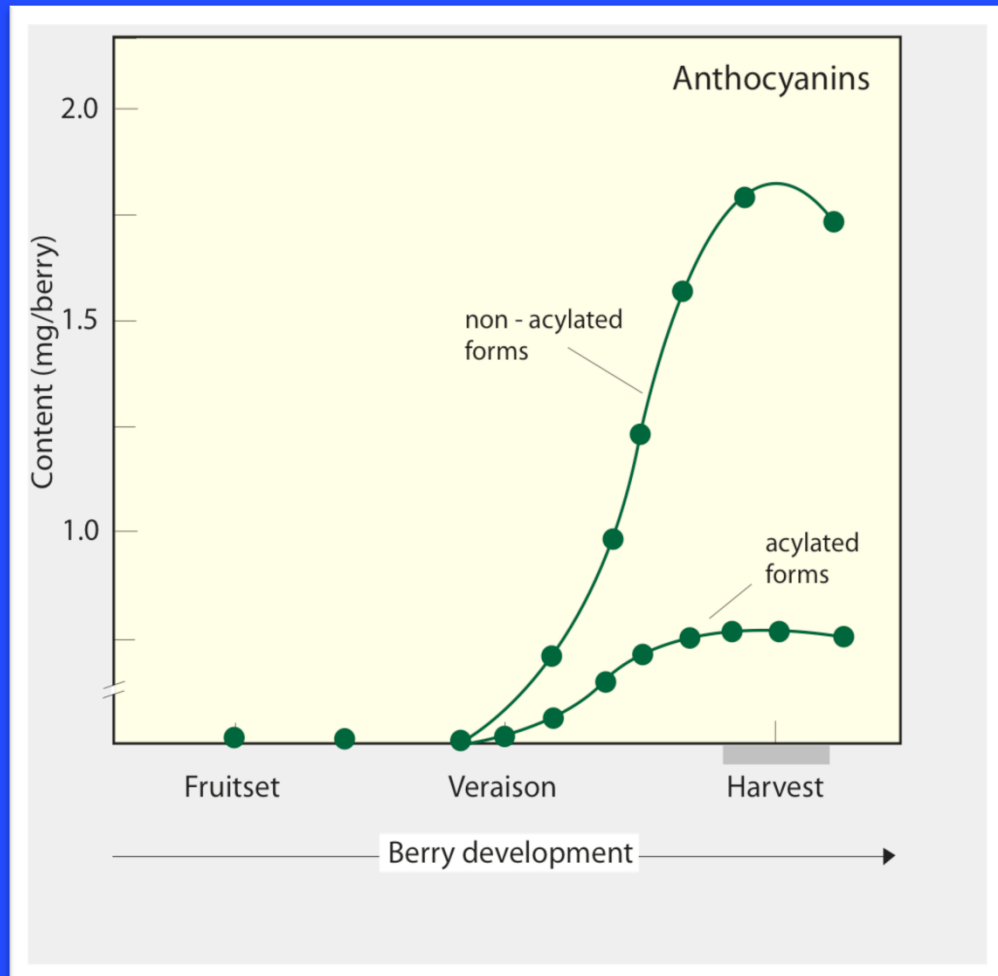
BERRIES

anthocyanins

monomers

tannins

Flavour development in the vineyard anthocyanins



Flavour development in the vineyard

WINE

Mouthfeel

hard

grippy

silky

velvety

grainy

powdery

mouthcoating

puckering

drying

BERRIES

Phenolic compounds

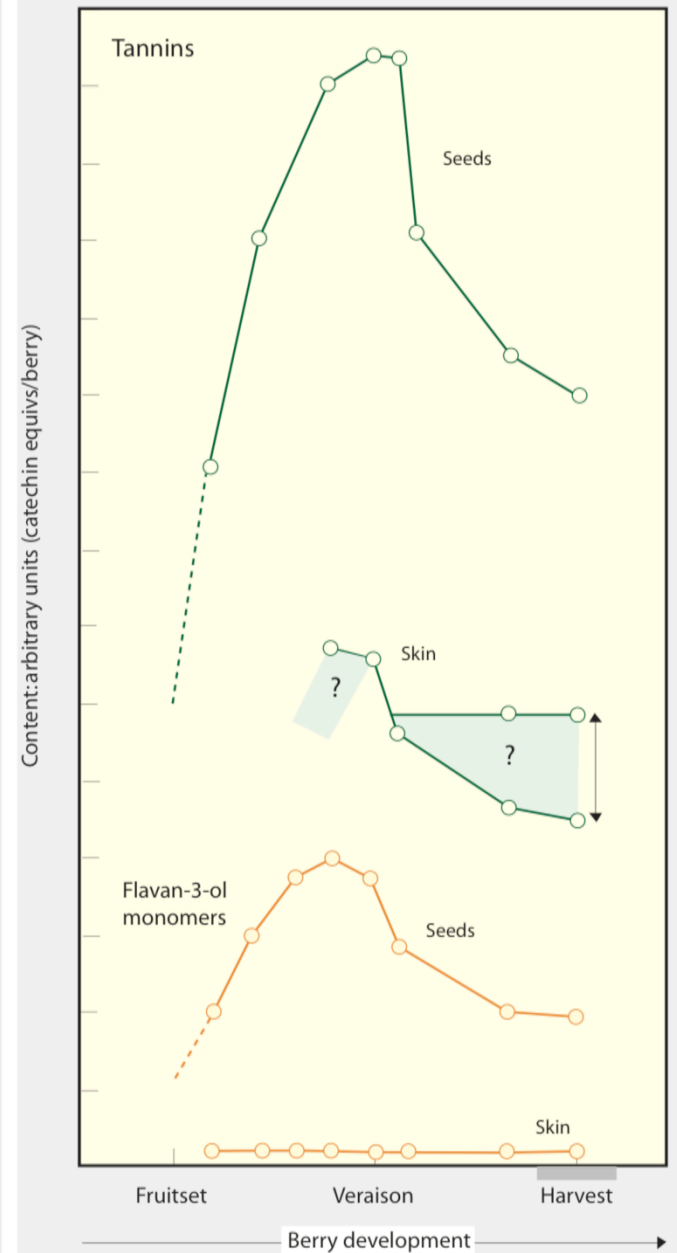
monomers — catechins

tannins

interactions with acidity /
alcohol/polysaccharides

Flavour development in the vineyard

Phenolic compounds
— catechins tannins



Flavour development in the vineyard

Volatile aroma compounds

WINE

Floral

Pepper

Green

Berry-like

Fruits (red and black)

BERRIES

terpenes

rotundone

pyrazines + precursors

damascenone ionone

esters +

Flavour development in the vineyard

WINE

floral

fragrant

roses

citrus

tropical fruit

red and black fruit

BERRIES

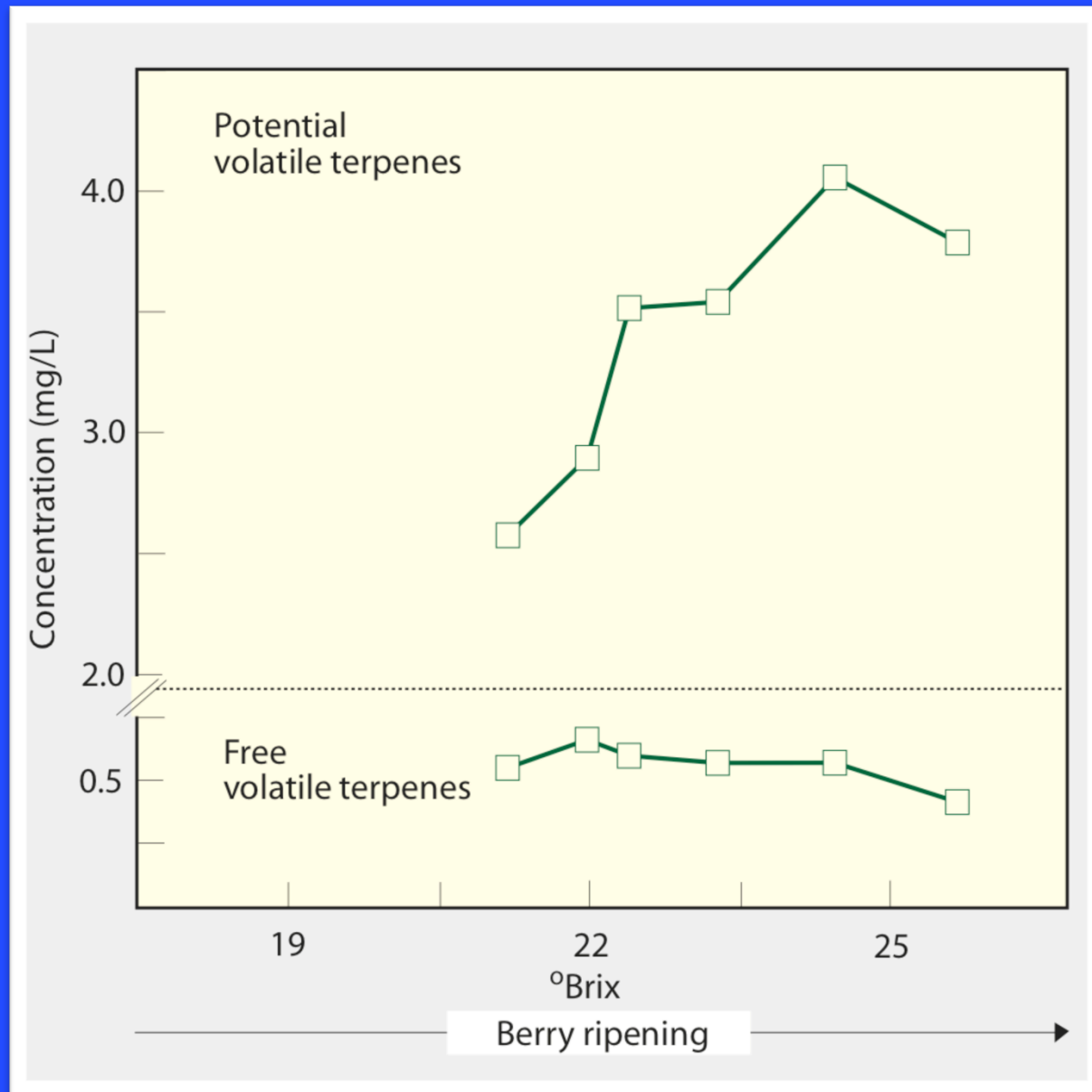
Free volatile terpenes

Potential volatile terpenes

Esters — formed from precursors
during fermentation

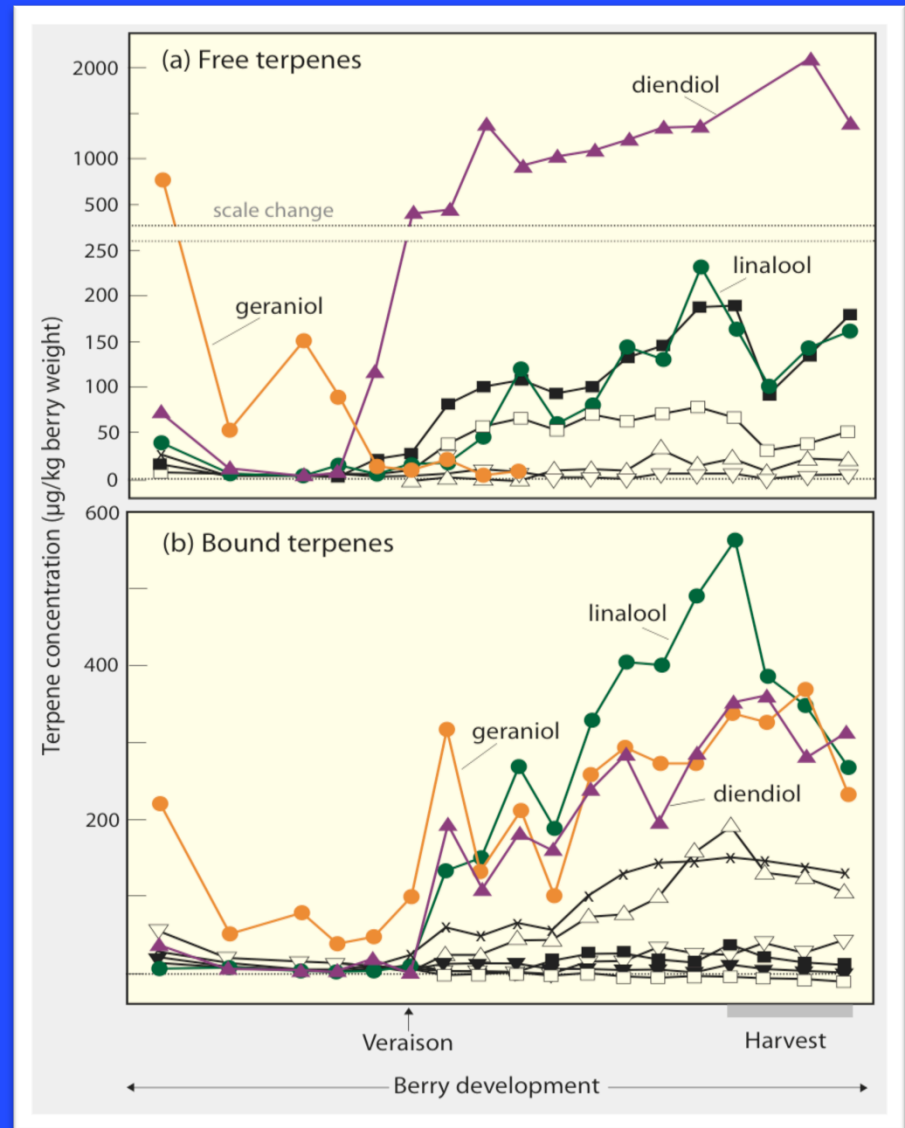
Flavour development in the vineyard

terpenes



Flavour development in the vineyard

terpenes

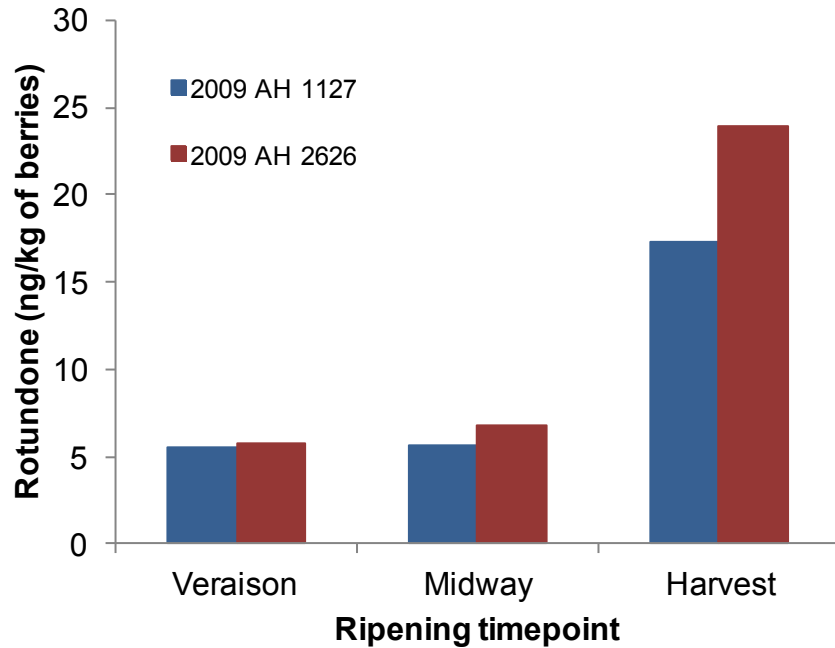


Flavour development in the vineyard rotundone

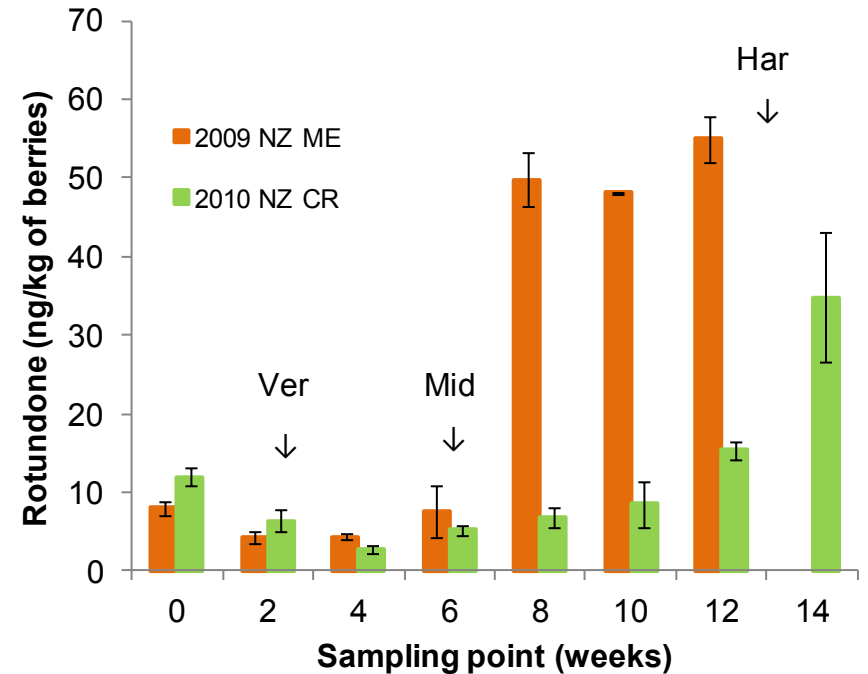
- The pepper sensation

Rotundone

Adelaide Hills Shiraz berries during ripening



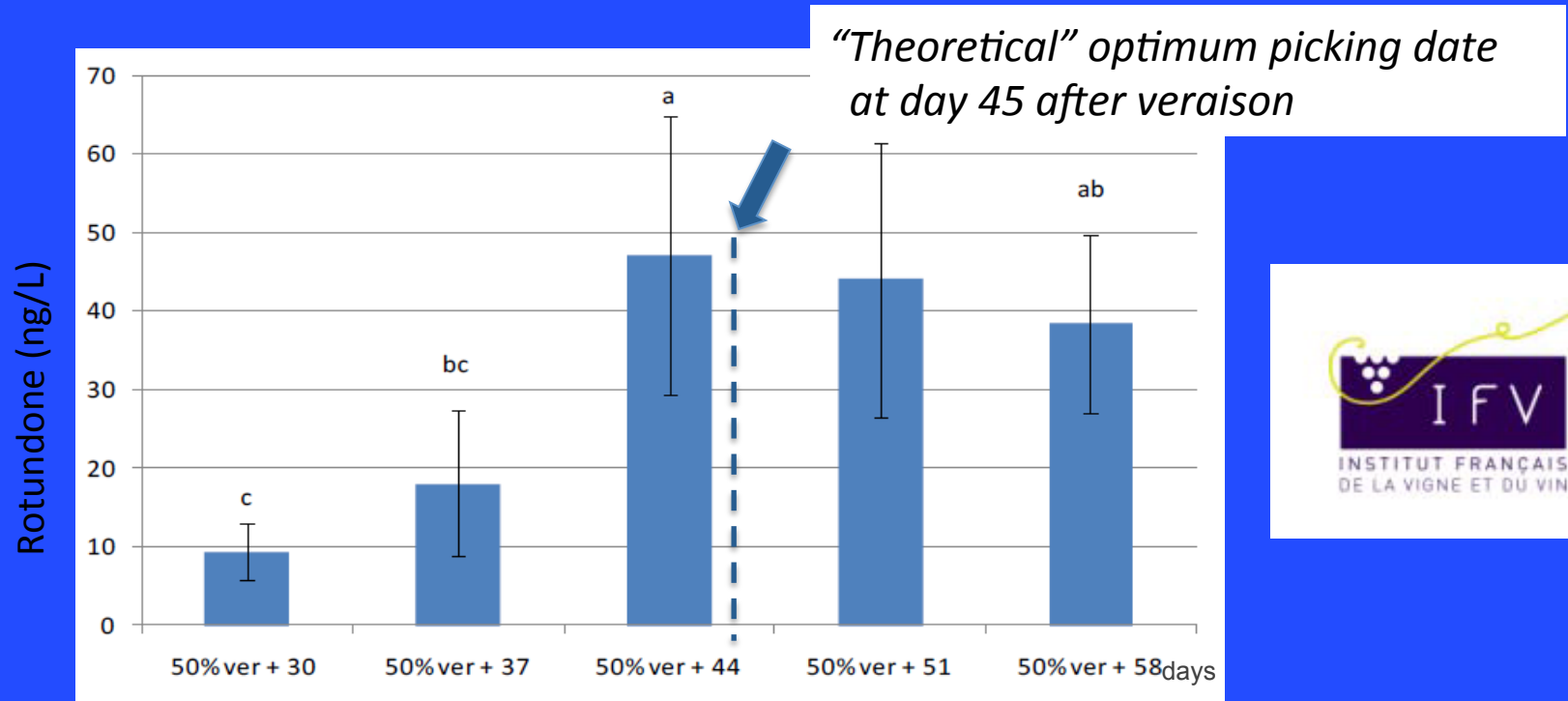
NZ Hawke's Bay Syrah berries during ripening



Rotundone in French Pyrenees wines

Olivier Geffroy, IFV Sud-Ouest

2011 Duras microvinification at five levels of maturity



IFV viticulture trials:

	2011	2012
Irrigation / Elicitor / crop load	43-48 ng/L	29-36 ng/L
Control	37 ng/L	27 ng/L
Leaf removal	12 ng/L	12 ng/L

Flavour development in the vineyard

WINE

green

herbaceous

grassy

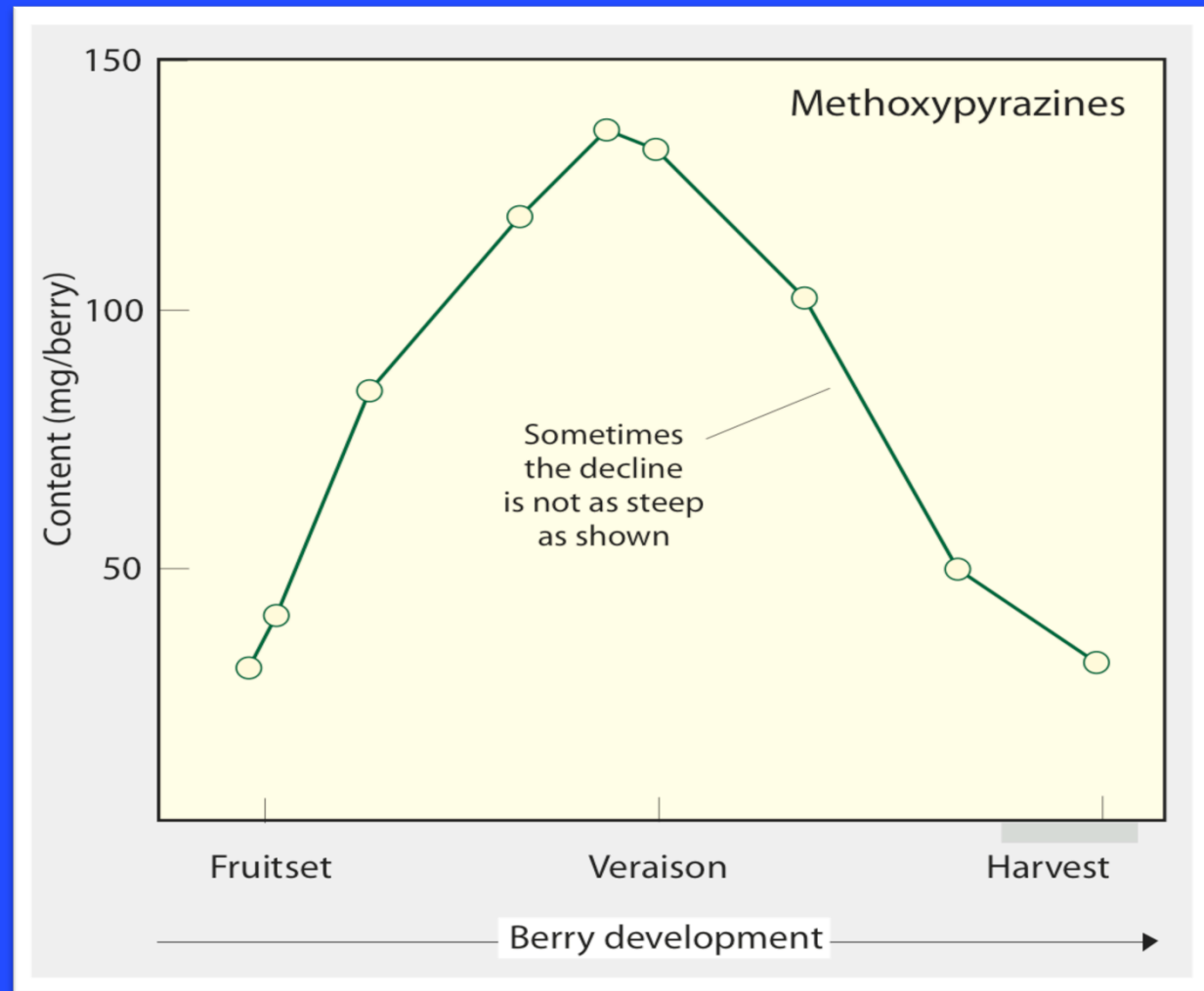
BERRIES

Methoxypyrazines

C6 aldehydes C6 alcohols

Formed from precursors on
crushing and during fermentation

Flavour development in the vineyard methoxypyrazines



Flavour development in the vineyard

WINE

sweet

violet

honey-like

stewed plum

raspberry

blackberry

plum

BERRIES

Norisoprenoids

damascenone

ionone

Free and bound forms

Esters formed during fermentation

Flavour development in the vineyard

damascenone ionone

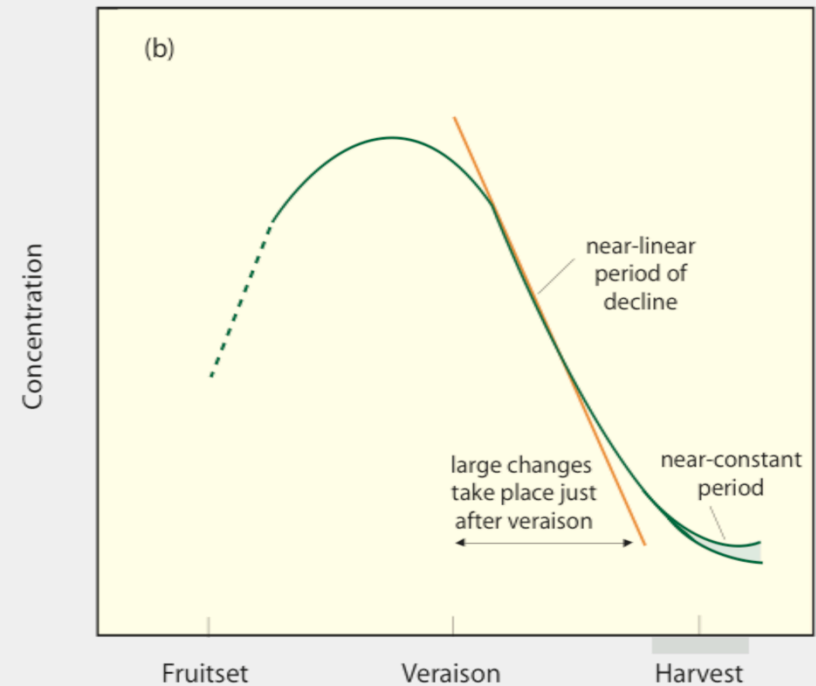
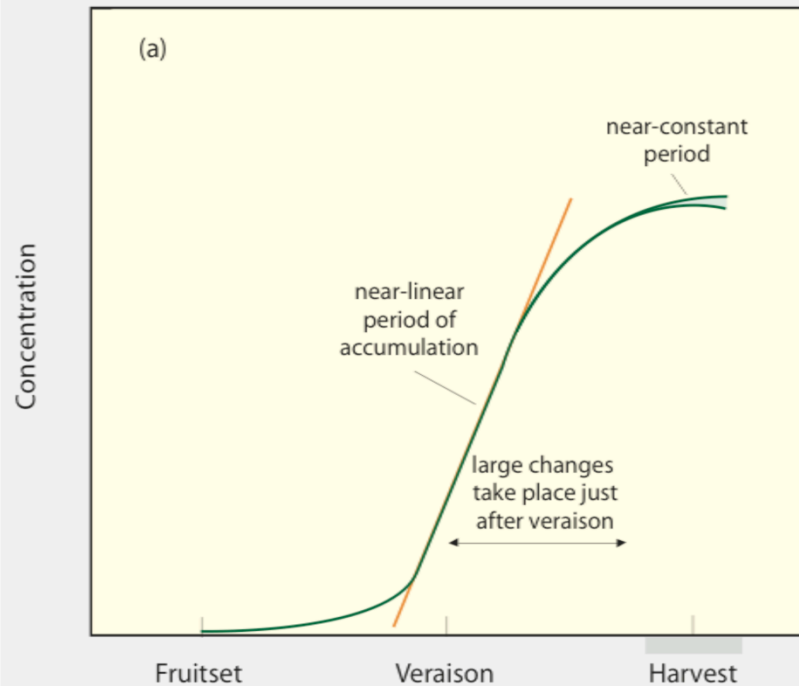
- formed during veraison to harvest
- exist in free and bound forms

Flavour development in the vineyard

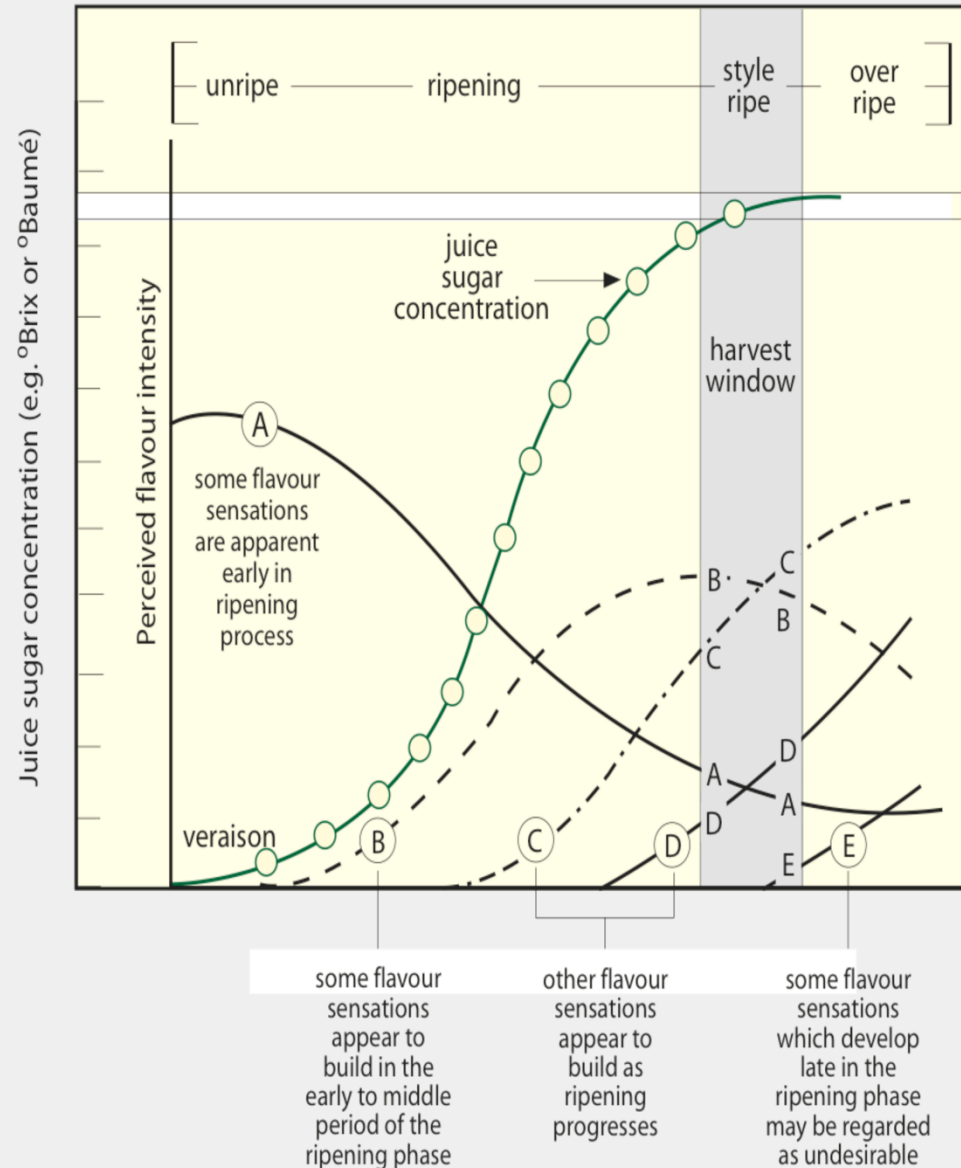
- What aroma compounds are present in different varieties ?

Flavour development in the vineyard

the ripening period



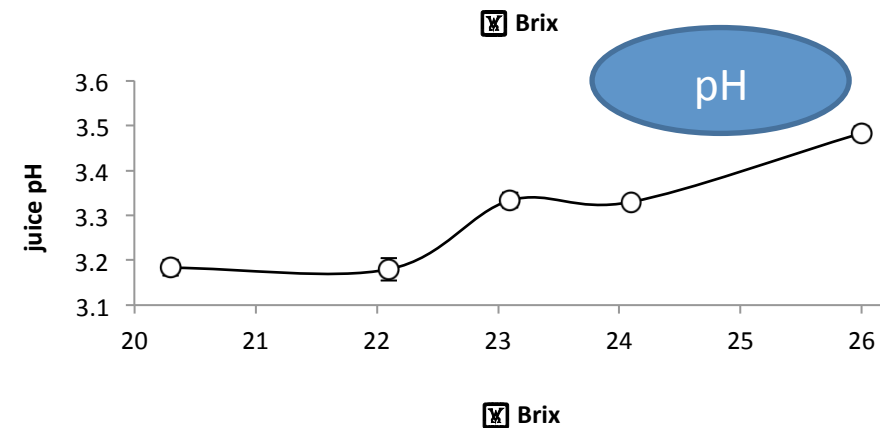
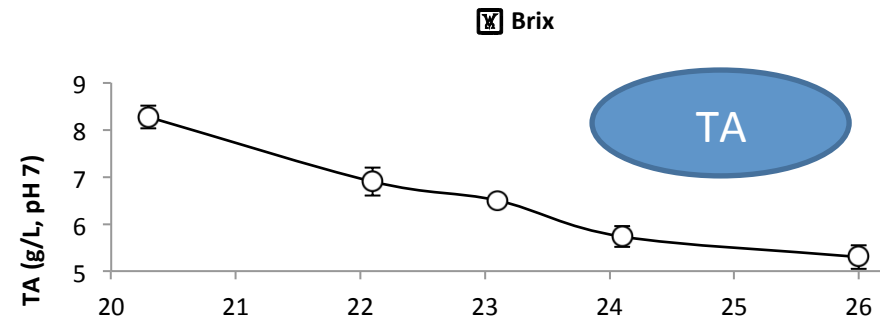
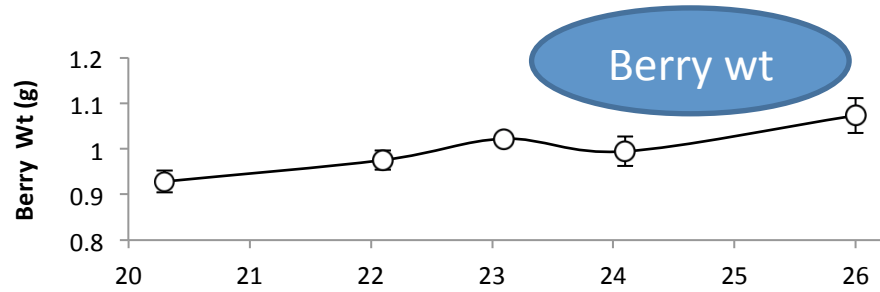
Flavour development in the vineyard towards the end of ripening



Flavour development in the vineyard

- Keren Bindon study (AWRI)
- Cabernet Sauvignon Langhorne Creek
- 5 ripening stages

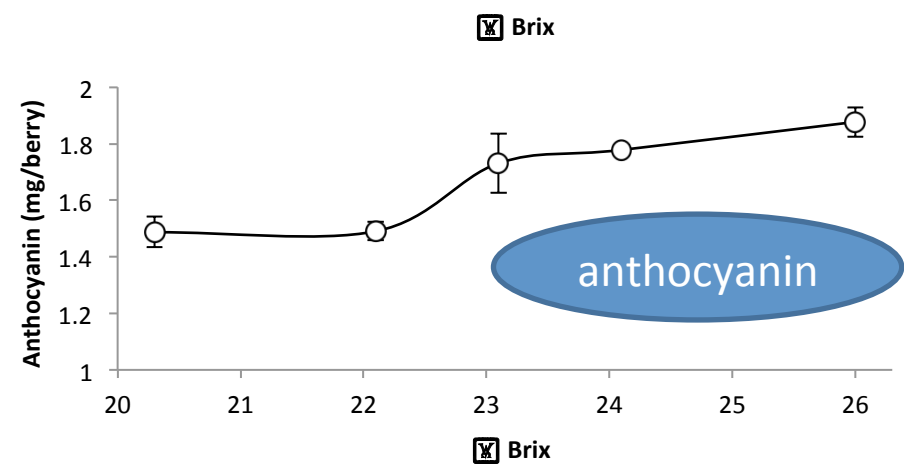
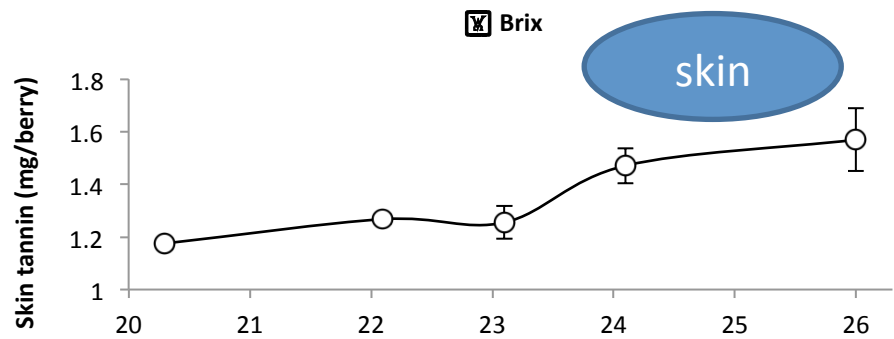
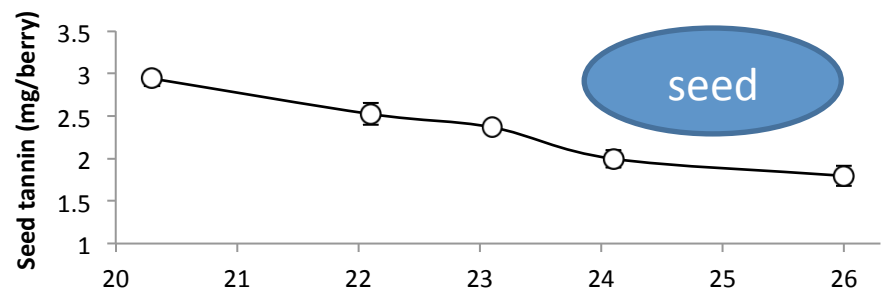
Berries



Berries

Tannins

Anthocyanins

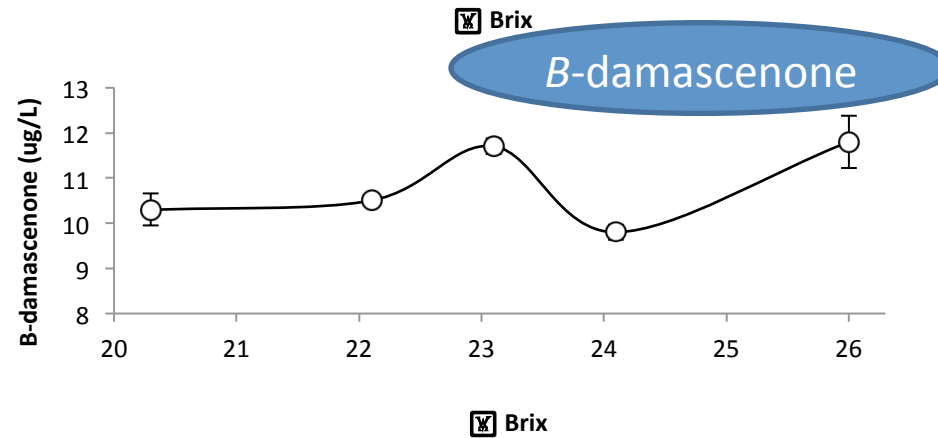
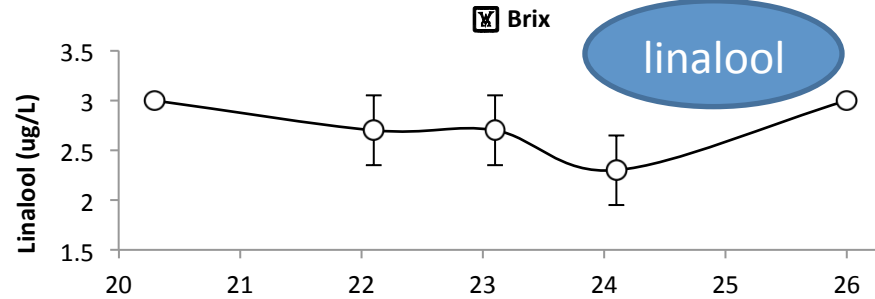
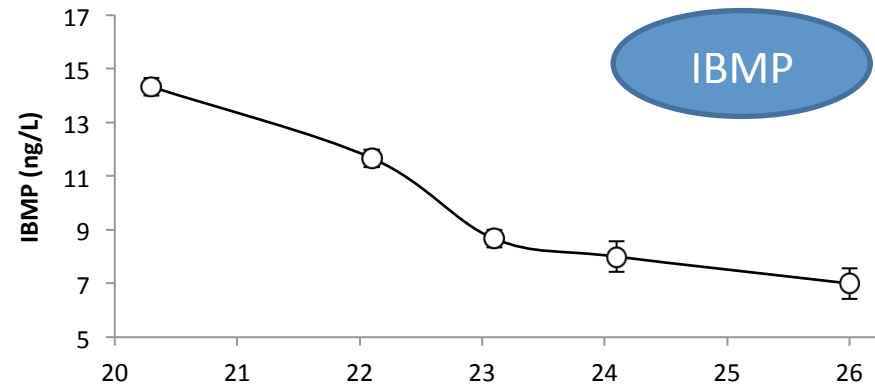


Wine

green

fragrant

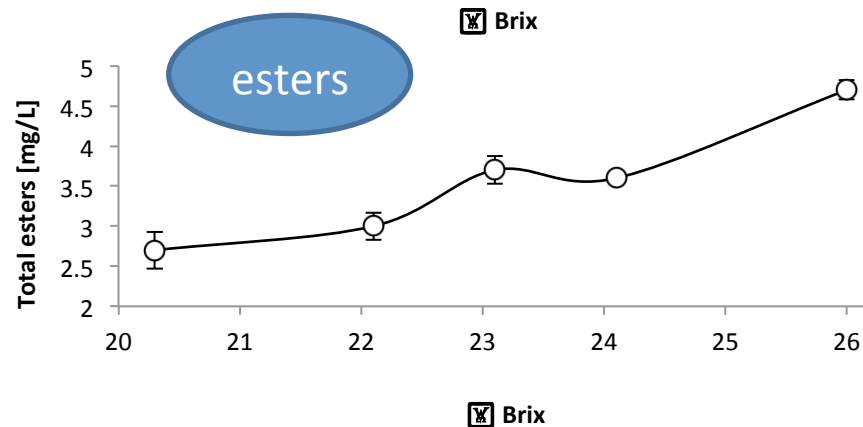
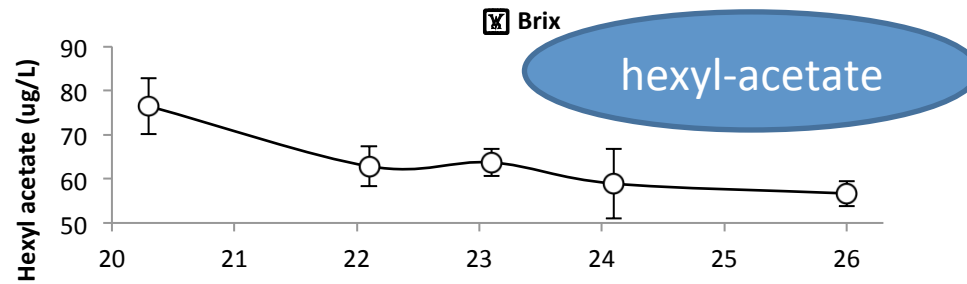
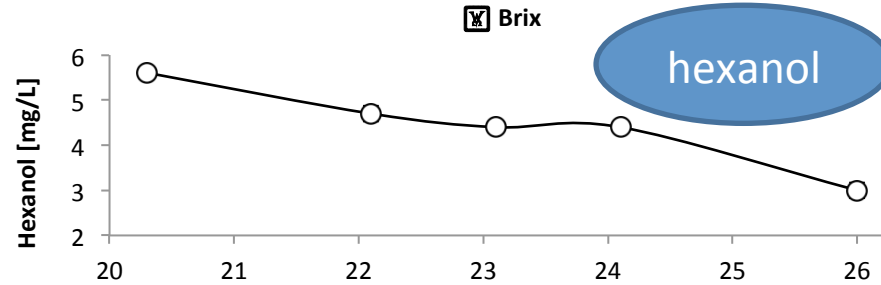
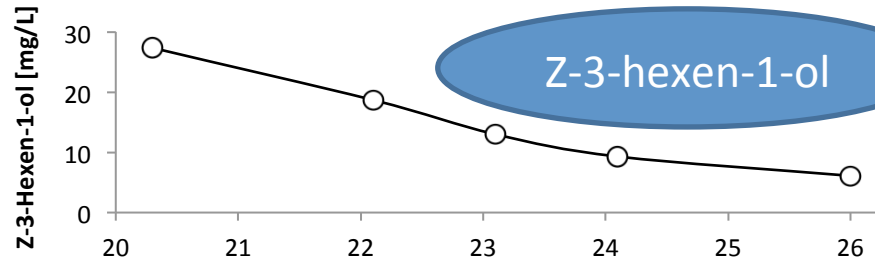
fruity



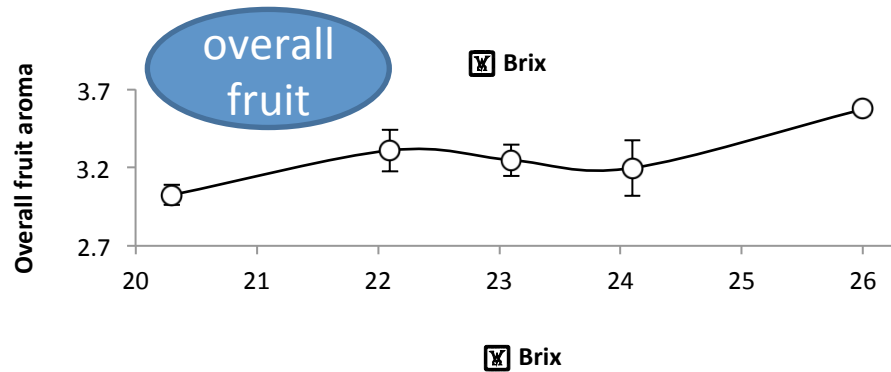
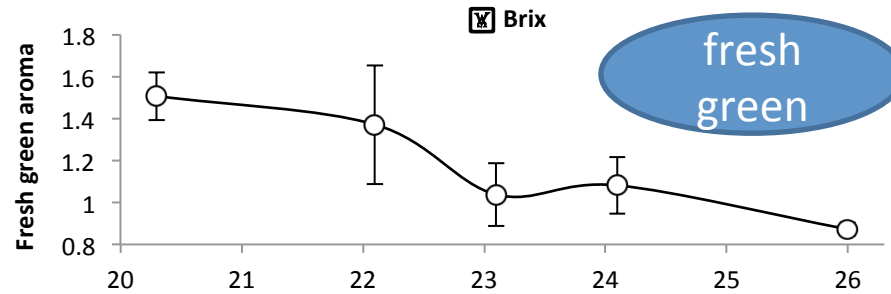
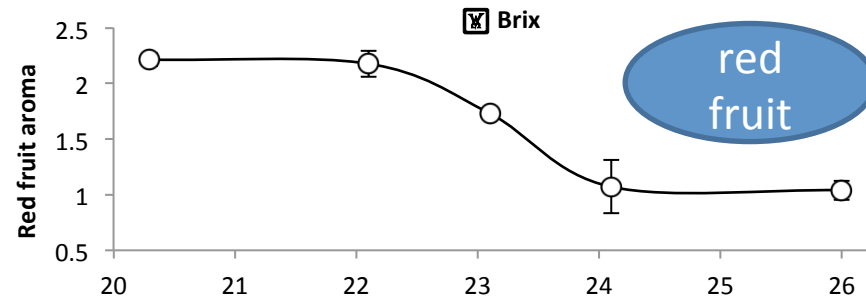
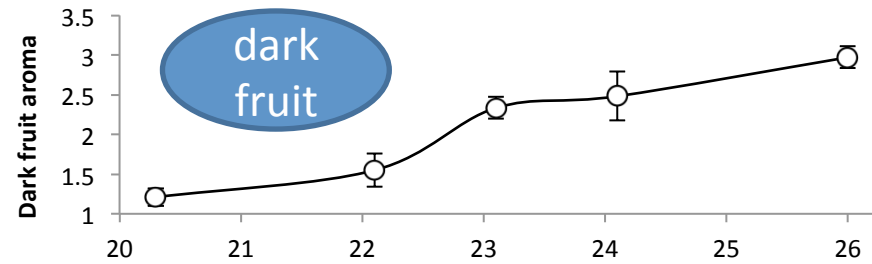
Wine

green

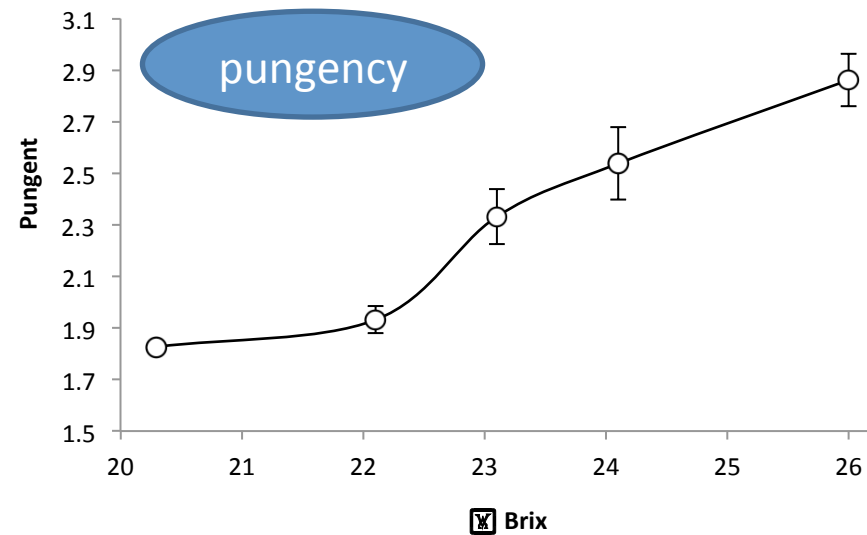
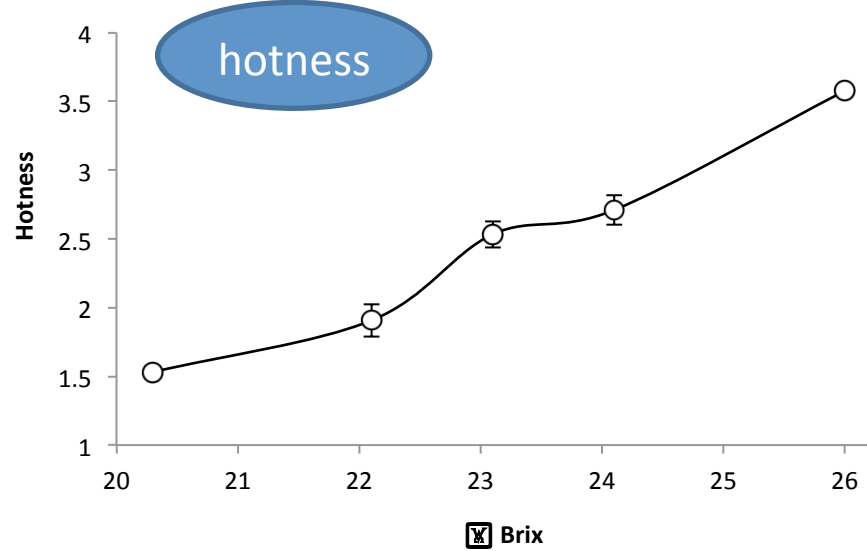
fruity



Wine

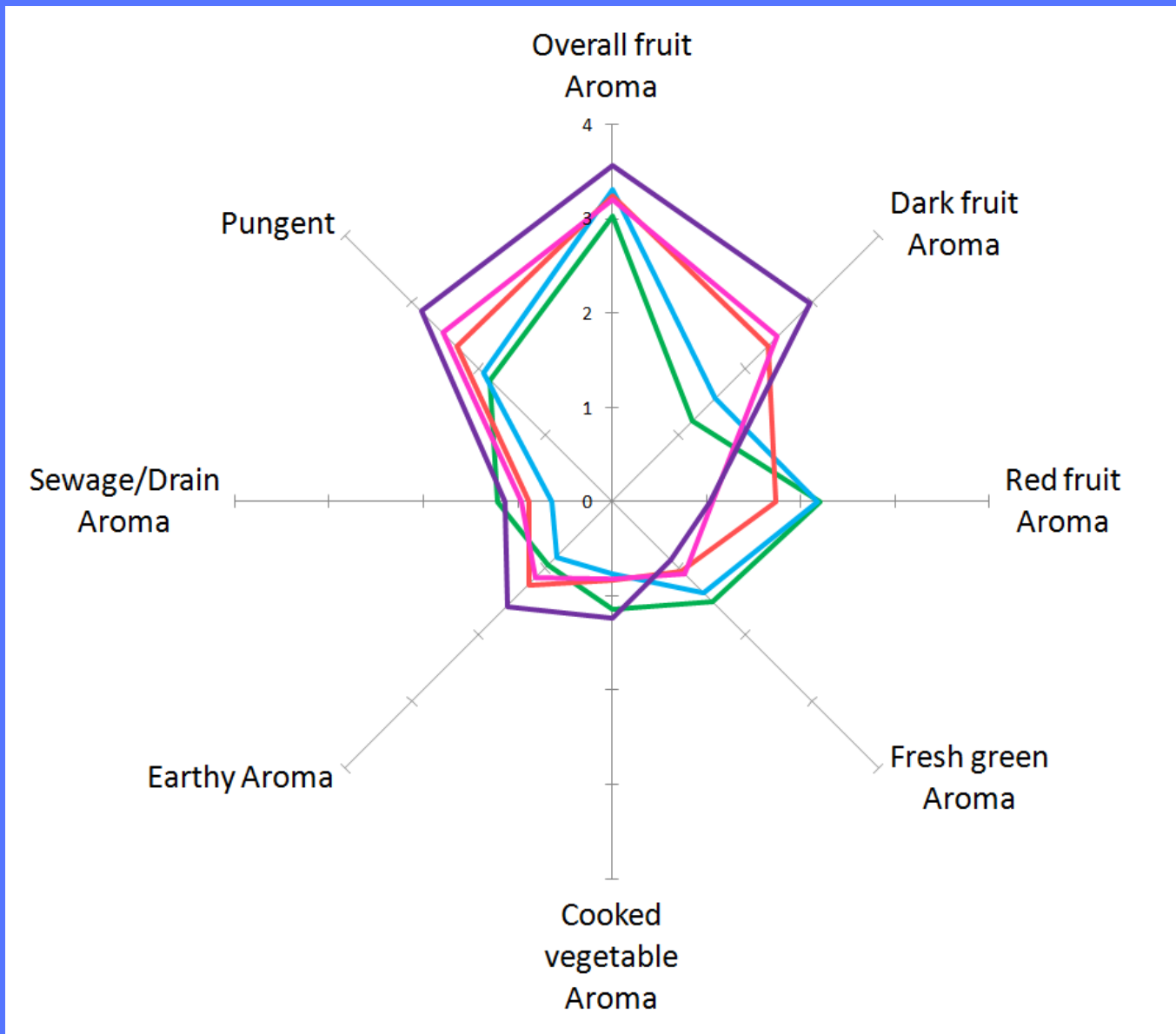


Wine



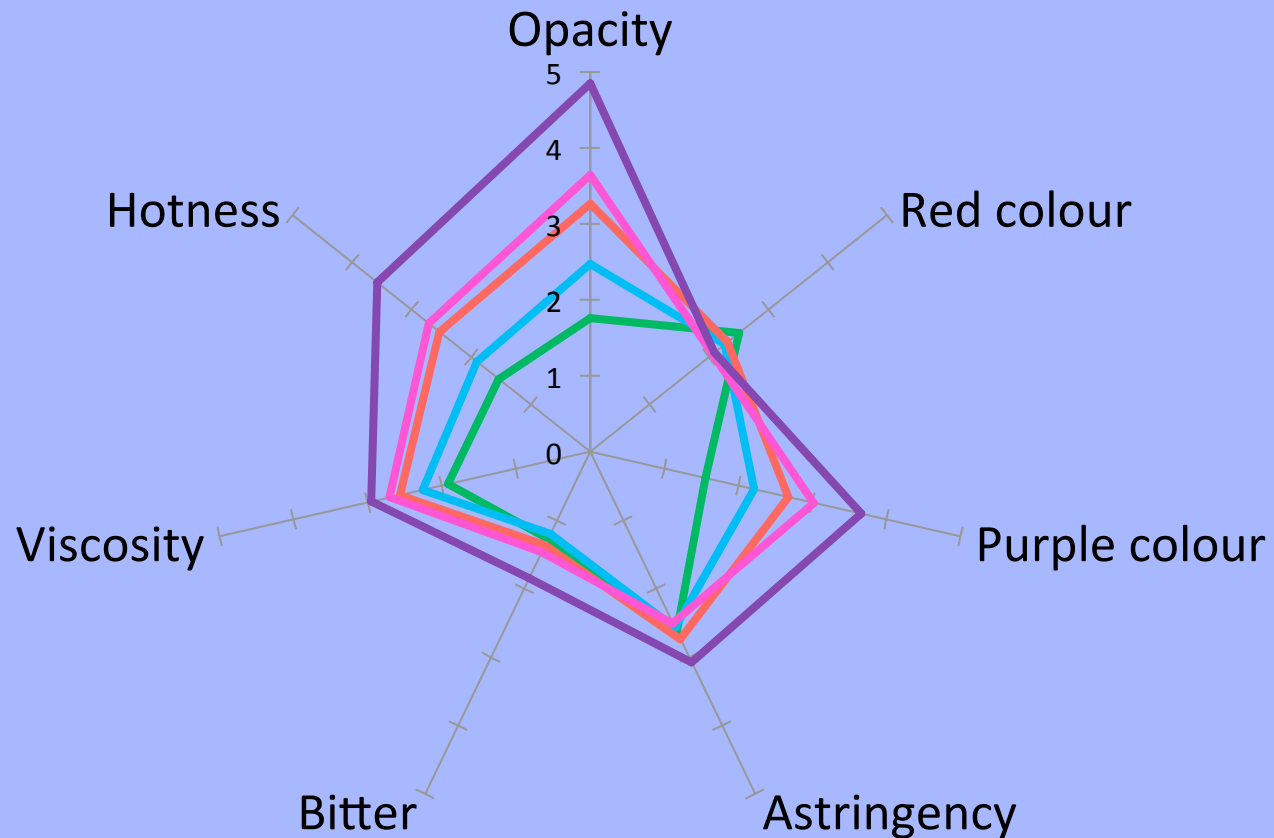
Flavour development in the vineyard

Keren Bindon

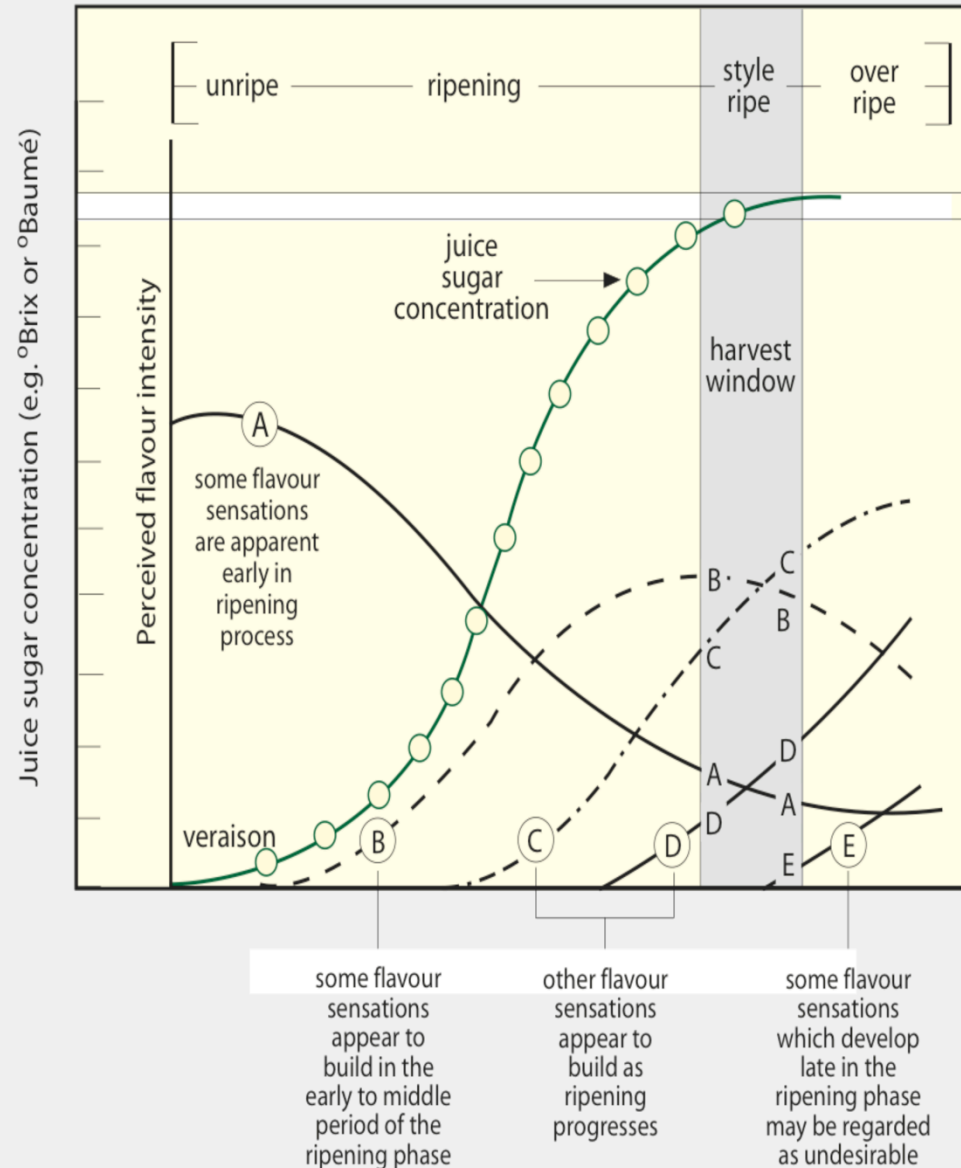


Flavour development in the vineyard

- Keren Bindon



Flavour development in the vineyard towards the end of ripening



Flavour development in the vineyard

- Green sensations in wine
 - herbaceous
 - tart
 - sharp
 - bitter
 - grippy
 - hard
 - astringent — drying

Flavour development in the vineyard

- Ripe sensations in wine

dark fruit + ? — earthy licorice

freshness

astringent — soft

mouthcoating

powdery

drying

BALANCE

Flavour development in the vineyard

Deciding when to harvest ?

- Juice + berry analysis
- Berry sensory analysis

Flavour development in the vineyard

- Berry sensory

Green sensations

Riper sensations — are we there yet?

Style ripe — there ?

Over-ripe — past it

VINEYARD ASSESSMENT SHEET (an example)

VINES

	Assessment Site		
	1	2	3
Main shoot length			
shoots trimmed	Yes	No	
% of shoots <50cm			
% of shoots 50-100cm			
% of shoots 100-150cm			
% of shoots 150-200cm			
% of shoots >200cm			
Average shoot length (cm)			
Number of leaves on average shoot			
Average internode length (nodes 6-7)			
% of shoots with growing tips			
Shoot lignification			
zero - little			
low			
moderate			
extensive			
fully lignified			
Extent of lateral growth			
low			
moderate			
extensive			
Leaf condition			
1. green, dull, healthy			
2. dark green, shiny, healthy			
3. green, healthy, lost turgor, backs visible			
4. pale green, wilting			
5. yellow leaves from shading			
6. basal leaves, yellowing from stress			
7. yellow leaves from autumnal senescence			
8. % leaves remaining			
9. other symptoms e.g. nutrient/salt/wind			
Assessment of overall leaf function (P, A, G or E)			
Canopy light condition			
heavily shaded			
partly shaded			
partly exposed (dappled light)			
fully exposed			
Average number of leaves in front of a bunch			
>3 leaves in front of a bunch			
3 leaves in front of a bunch			
2 leaves in front of a bunch			
1 leaf in front of a bunch			
no leaves in front of a bunch			
% Bunch exposure			

NOTES

Date of veraison:

Vineyard details:

Assessment date:

BERRIES

	Assessment Site				Assessment Site		
	1	2	3		1	2	3
Weight							
Size							
Berry shrivel (%)				Berry colour / Juice colour			
Deformability				Comments			
very soft							
soft							
firm							
hard							
Flesh texture				Sugar-acid balance			
watery				acidic			
juicy				balanced			
firm				sweet			
hard				very sweet			
raisin				fresh			
Aroma descriptors (l = low; m = medium; h = high)							
eg herbal				Comments:			
spicy				eg green,			
peppery				overripe,			
cherry				other			
raspberry							
plum							
blackberry							
earthy							
raisiny							
Skin thickness				Skin integrity & feel			
thin				shreds easily			
medium				firm & soft			
thick				firm & leathery			
Skin astringency (1-5)				Skin ripeness (1-5)			
puckering							
drying							
Seed colour				Seed hardness			
green				brittle			
light brown				hard			
brown				cracking			
dark brown							
Seed aroma				Seed astringency (1-5)			
pungent							
herbaceous							
biscuit				Seed ripeness (1-5)			
nutty							
toasty							
Juice and berry analysis							
°Brix/°Baumé				Comments			
pH							
Titrateable acidity							
Berry colour conc							
YAN							
Other							
Disease incidence and severity and fruit condition							
Botrytis, Powdery mildew, Downy mildew, Splitting,							
Sunburn, Heat damage, Other							
Record % incidence and % severity of each disease or damage							

Flavour development in the vineyard

Deciding when to harvest ?

Chardonnay

grassy

green apple

citrus lemon lime

peach

pineapple

rockmelon

lack of herbaceousness

freshness

ripe seeds

Flavour development in the vineyard

Deciding when to harvest ?

Pinot Noir

herbs

spice

cherry

rhubarb

strawberry

raspberry

plum

stewed plum

freshness

ripe seeds

ripe skins

Flavour development in the vineyard

Summary

During berry ripening — general progression from green to ripe flavour characters

aroma, tastes and mouthfeel

Chemical analysis

Berry sensory assessment