

The Concept of Terroir

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Terroir – a trans-disciplinary concept

The word ‘terroir’ is derived from the Latin.

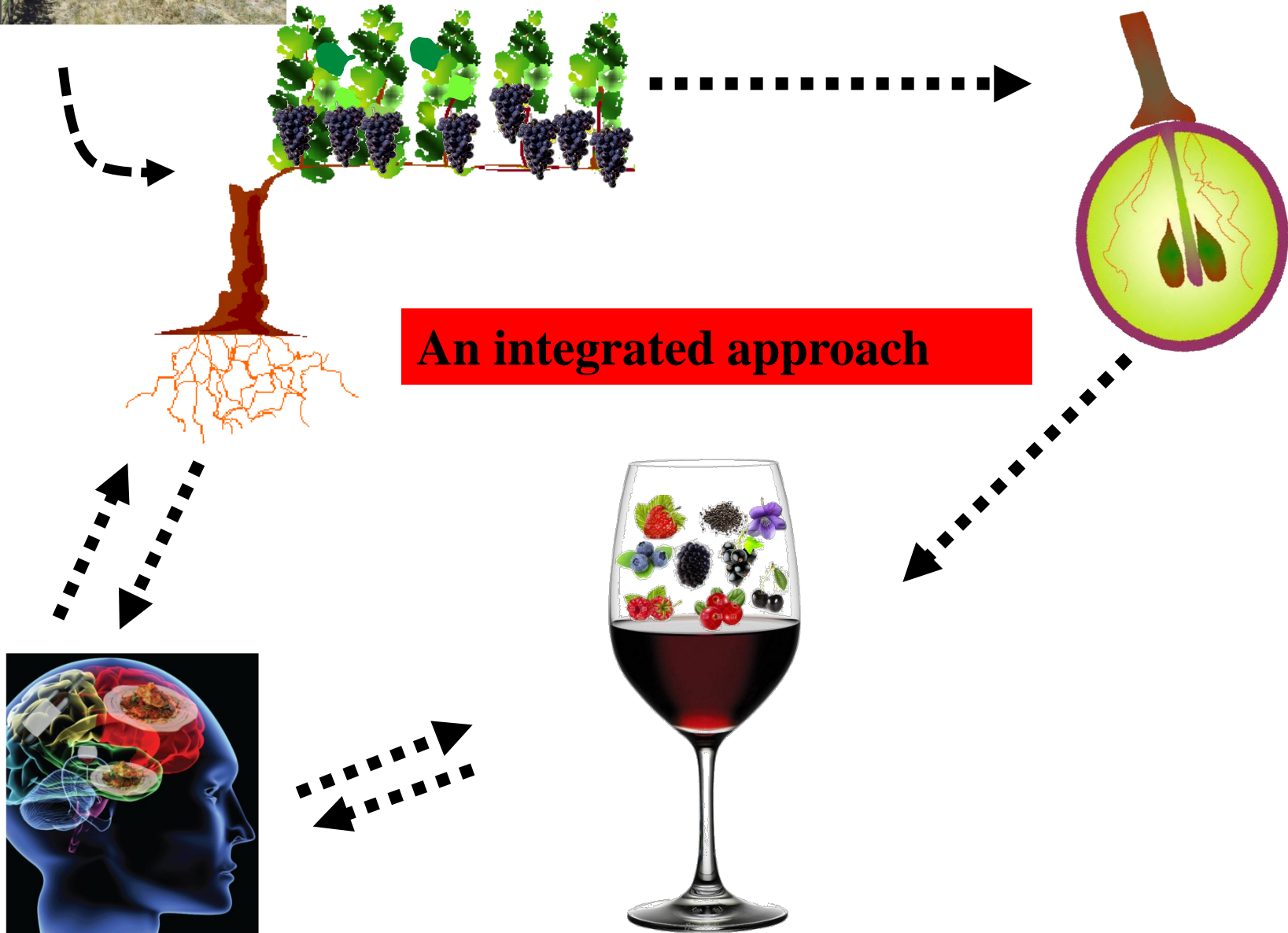
It became established as a **geographical term** during the **17th and 18th** centuries, when it was employed to describe the characteristics of a **homogeneous physical area**.

This led to the first definition in modern language: “**a stretch of land limited by its agricultural capacity**”.

Thus, in the case of viticulture-oenology, the terroir concept has progressively integrated the **agronomic, social and cultural** dimensions of the area under consideration.



From the vineyard to the wine and sensory:
how to capture the complexity?

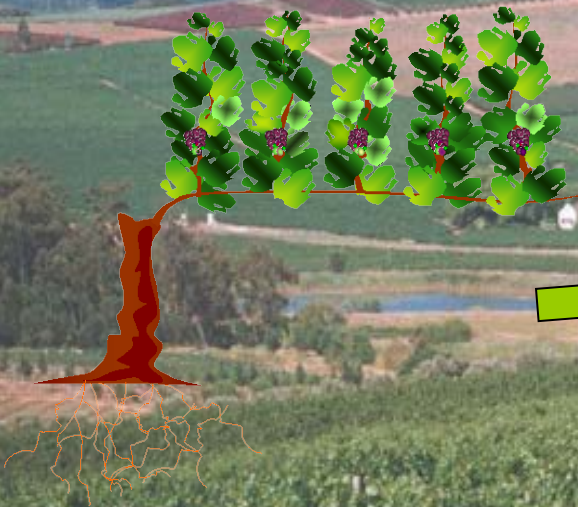


An integrated approach

Climate: a key factor of the **terroir** concept



Temperature
Light
Wind
Air humidity
Rainfall



Climatic scales

Time

Year
Season

Month

Decade

Day

Hour

Minute

Macroclimate

Meso-climate
Topoclimate

Microclimate
Nanoclimate

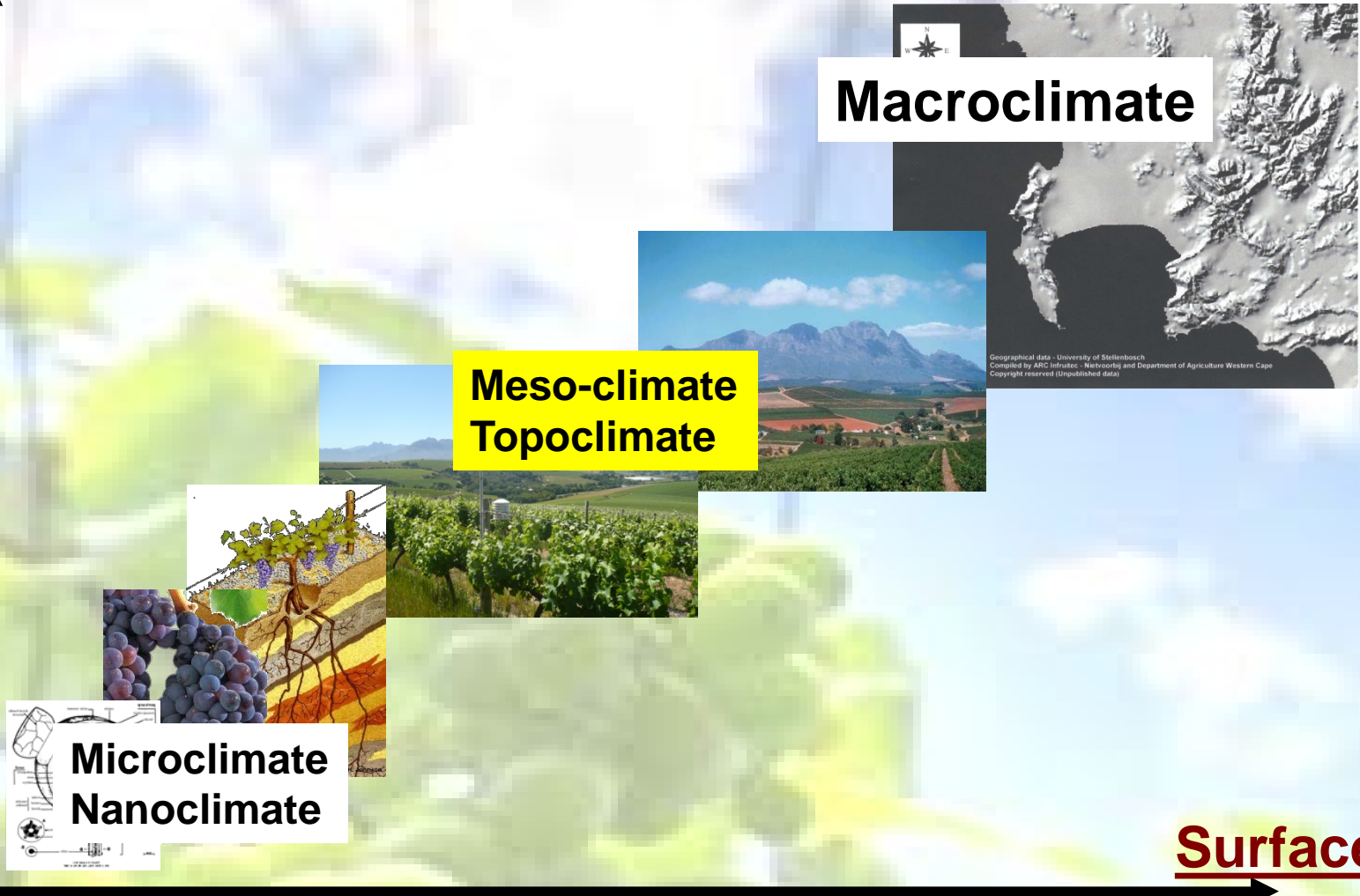
Surface

Bunch
Berry

Plot
Row

District
Ward

Province
Region



Frequency of vintages according to Huglin index classified as very warm (HI>3000) for Griffith (NSW)

Classification of viticultural climates (Tonietto and Carbonneau, 2004)

Very warm: >3000

Warm: >2400≤3000

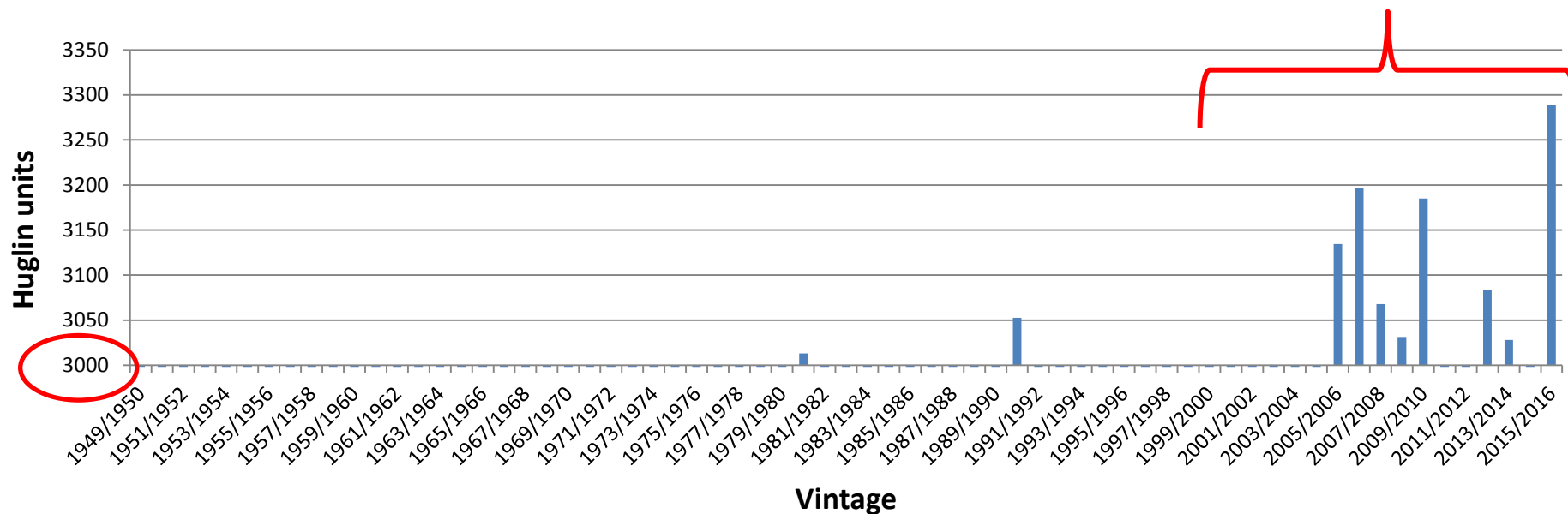
Temperate warm: >2100≤2400

Temperate: >1800≤2100

Cool: >1500≤1800

Very cool: ≤ 1500

An increase of very warm vintages



Climatic data used are SILO drilled climatic data (Department of Science, Information Technology and the Arts, Queensland State Government, Australia).

Cold night index for period January-February, Griffith

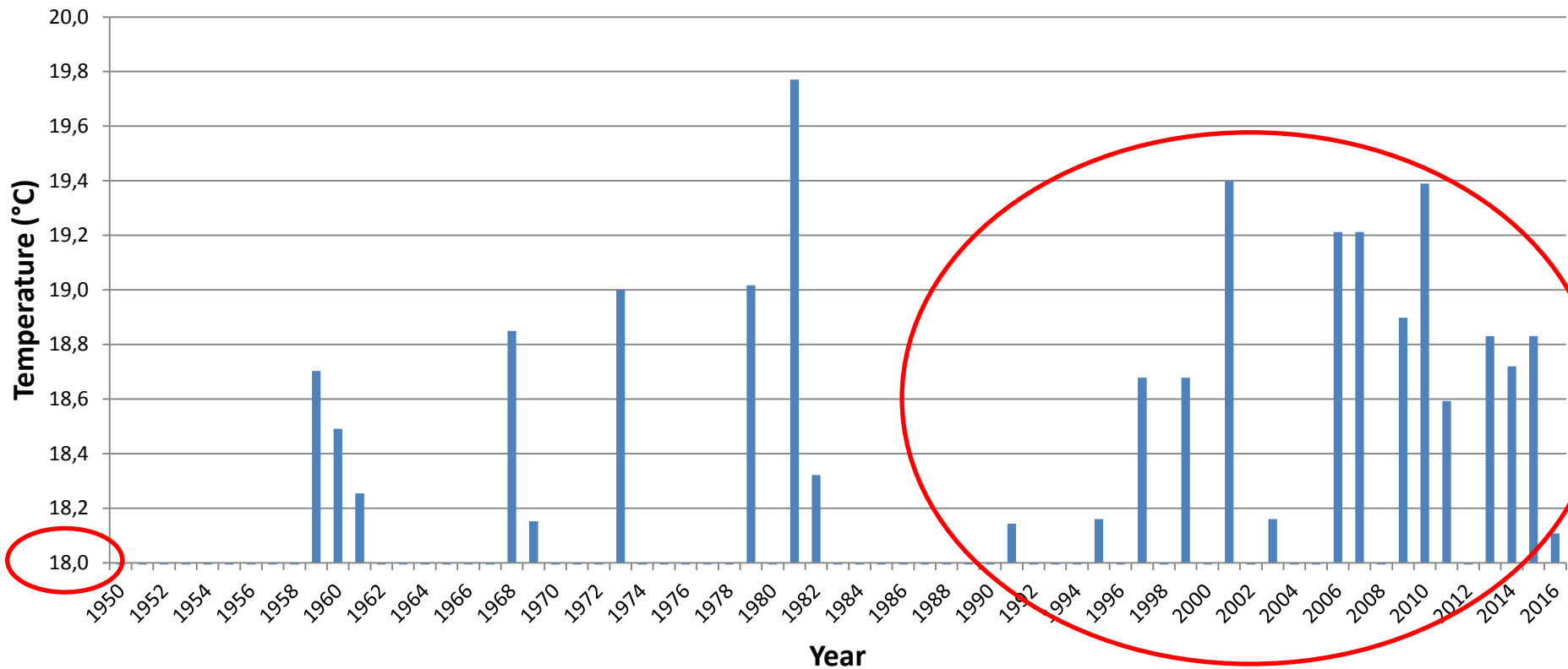
Classification of viticultural climates (Tonietto and Carbonneau, 2004)

Warm nights: >18

Temperate nights: $>14 \leq 18$

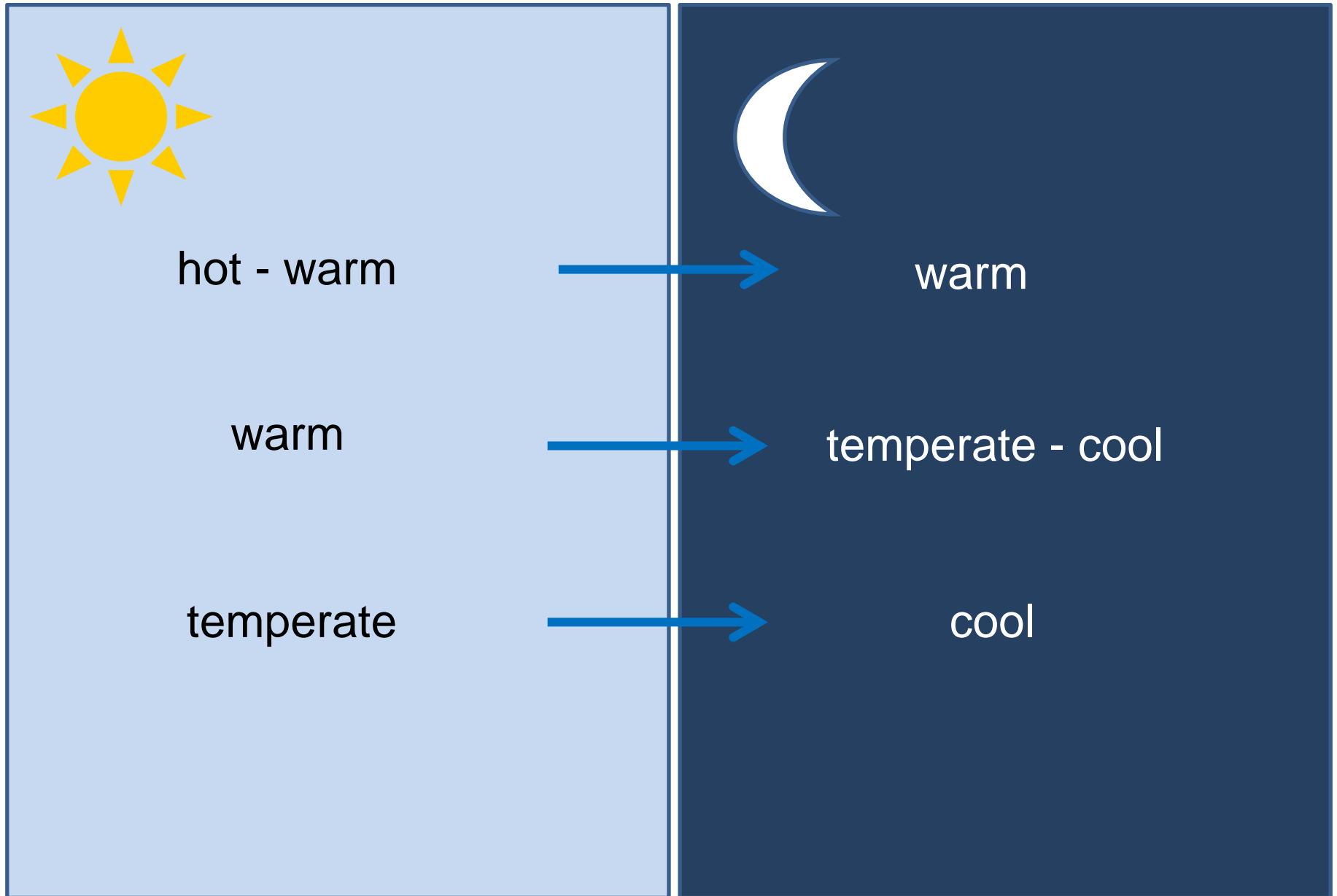
Cool nights: $>12 \leq 14$

Very cool nights: ≤ 12



Climatic data used are SILO drilled climatic data (Department of Science, Information Technology and the Arts, Queensland State Government, Australia).

Day and night temperature and link to wine styles?



Is Transcriptomic Regulation of Berry Development More Important at Night than During the Day?

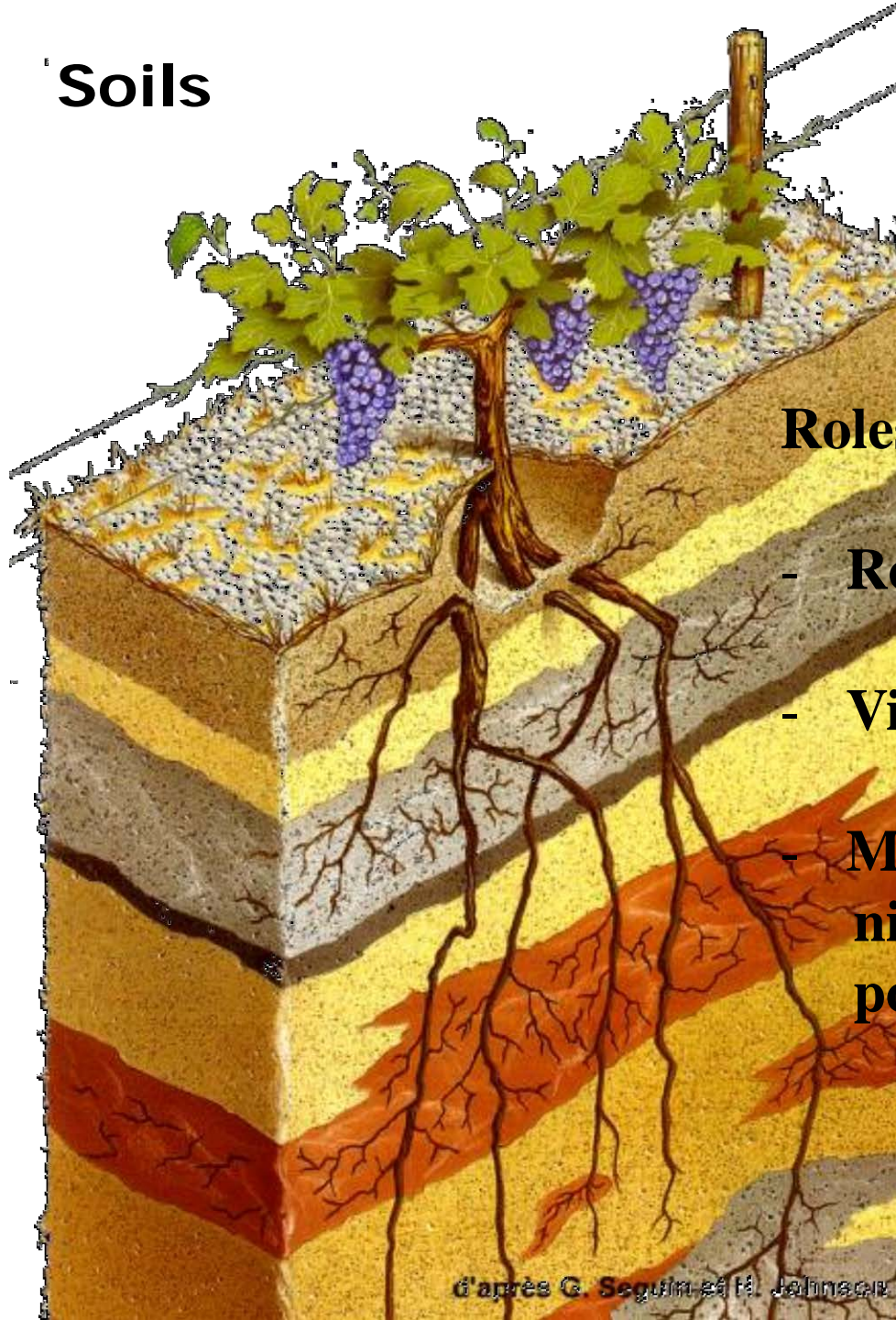
Markus Rienth^{1,2}, Laurent Torregrosa², Mary T. Kelly³, Nathalie Luchaire^{2,4}, Anne Pellegrino⁴, Jérôme Grimplet⁵, Charles Romieu^{6*}

¹ Fondation Jean Poupelain, Javrezac, France, ² INRA-SupAgro, UMR AGAP, Montpellier, France, ³ Laboratoire d'Oenologie, UMR1083, Faculté de Pharmacie, Montpellier, France, ⁴ INRA, UMR LEPSE, Montpellier, France, ⁵ ICVV (CSIC, Universidad de La Rioja, Gobierno de La Rioja), Logroño, Spain, ⁶ INRA, UMR AGAP, Montpellier, France

9273 developmentally modulated probsets.

All day-detected transcripts were modulated at night, whereas 1843 genes were night-specific.

Soils



Roles of the soil

- Root morphology and distribution
- Vine water uptake
- Minerals uptake:
 - nitrogen** (berry growth, aroma precursors)
 - potassium** (berry pH)

Cultivars (clones)



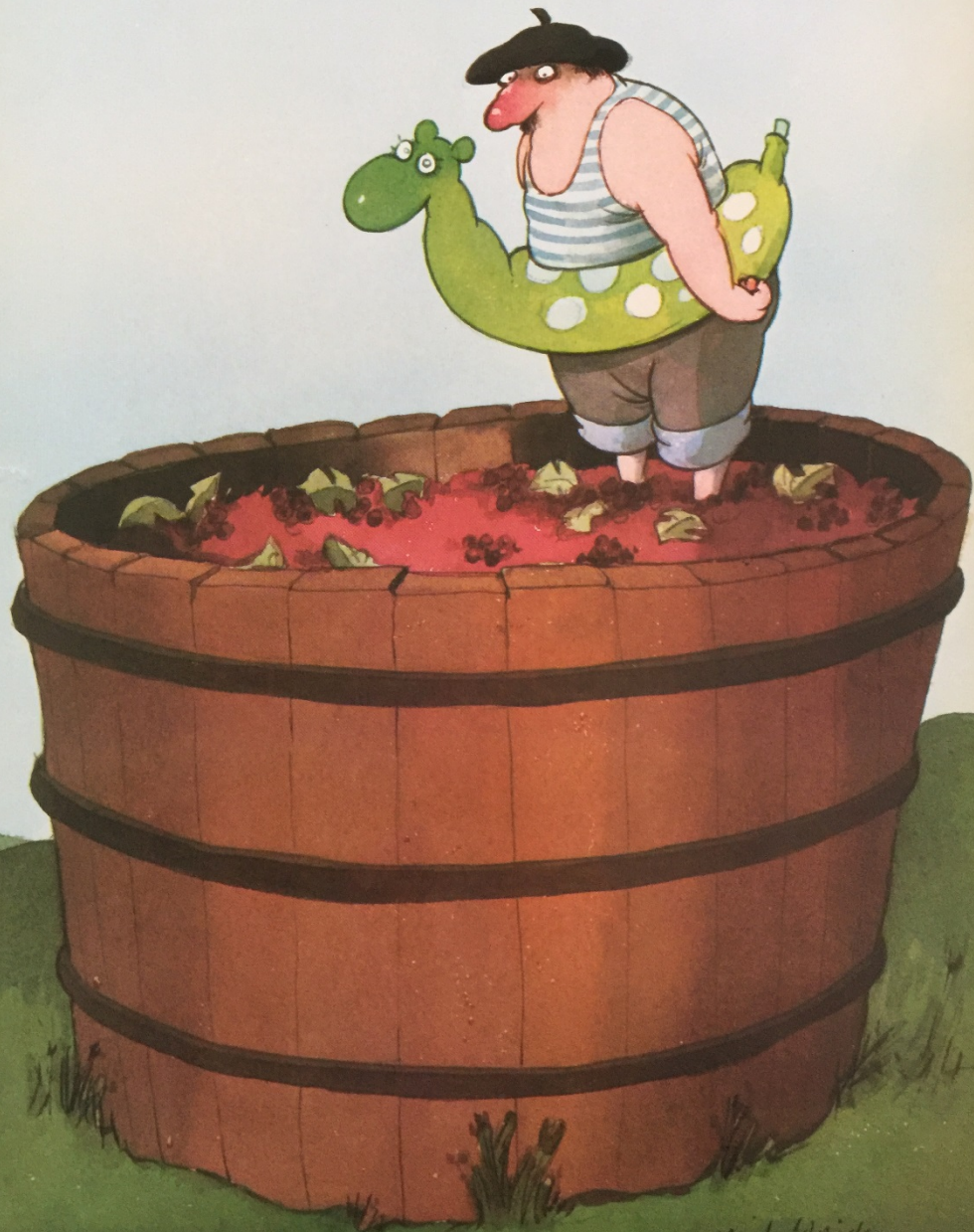
Sauvignon Blanc, Chardonnay, Riesling,...

Cabernet Sauvignon, Shiraz, Merlot,
Chamboursin...



Oenological process

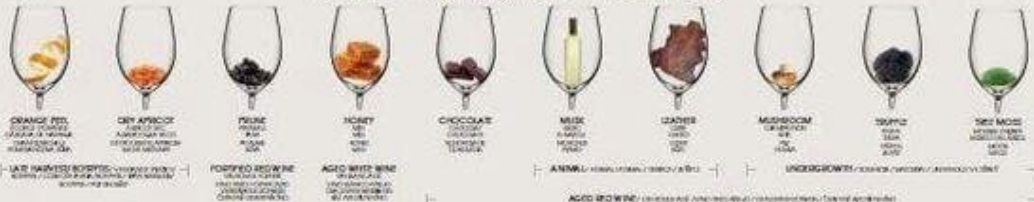




Michel Brudenne

WINE AROMAS

ARÒMES DU VIN / AROMAS DEL VINO / WEINAROMEN / VŮNĚ VÍNA



Typicality: a consensus on the taste between the tasters (*wine styles*).

Wine tasting:
it's an individual thing!

mmm,... cherry!...

...walnut!...

... fruitcake!...

...it's an individual thing!

mmm,... printing ink!...

.... old socks!...

.... car tyres!...

do you think so?!

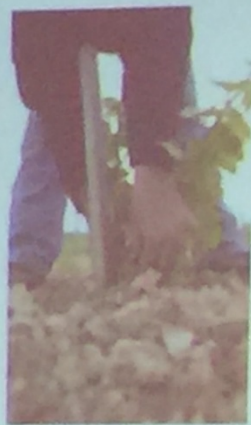




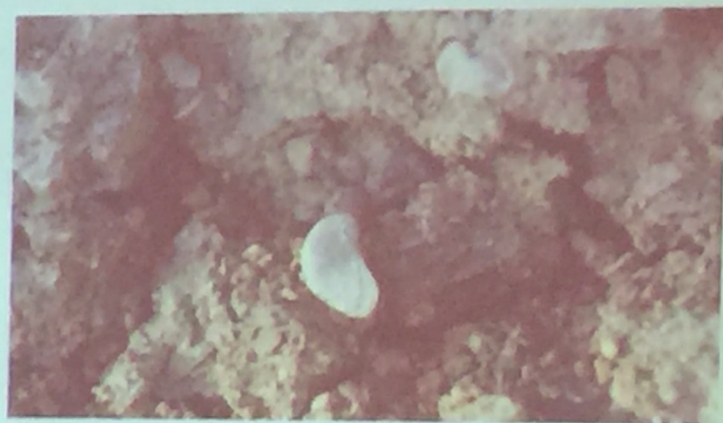
While tasting and be a member
of a “confrerie bachique”

You need a bit of equipment

Un Terroir



Sol calcaire, formé au **Kimméridgien** (il y a environ 150 millions d'années), lorsqu'une mer chaude et peu profonde recouvrait Chablis. Contient des fossiles de petites huîtres appelées *Exogyra virgula*.

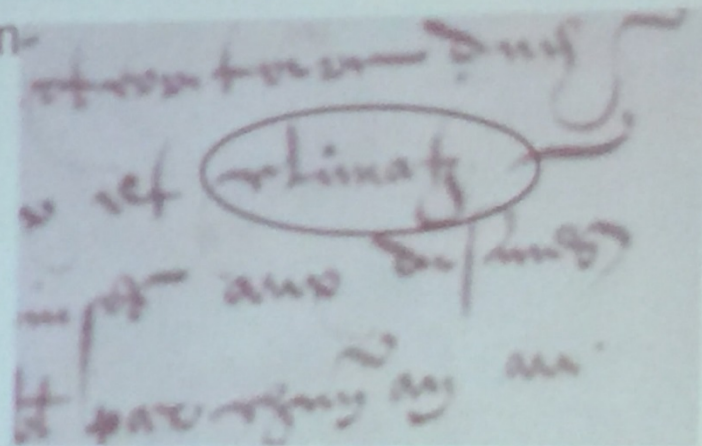




Les Climats

Les Climats peuvent être décrits comme l'ADN du vignoble de Bourgogne

- parcelles précisément délimitées
- bénéficiant de conditions géologiques et climatiques spécifiques
- identifiées et mises en valeur par le travail des hommes



Chablis

Le vignoble de Chablis, situé sur une zone géographique relativement concentrée, s'exprime au travers d'un seul cépage et puise son authenticité dans un sol datant du Kimmeridgien,

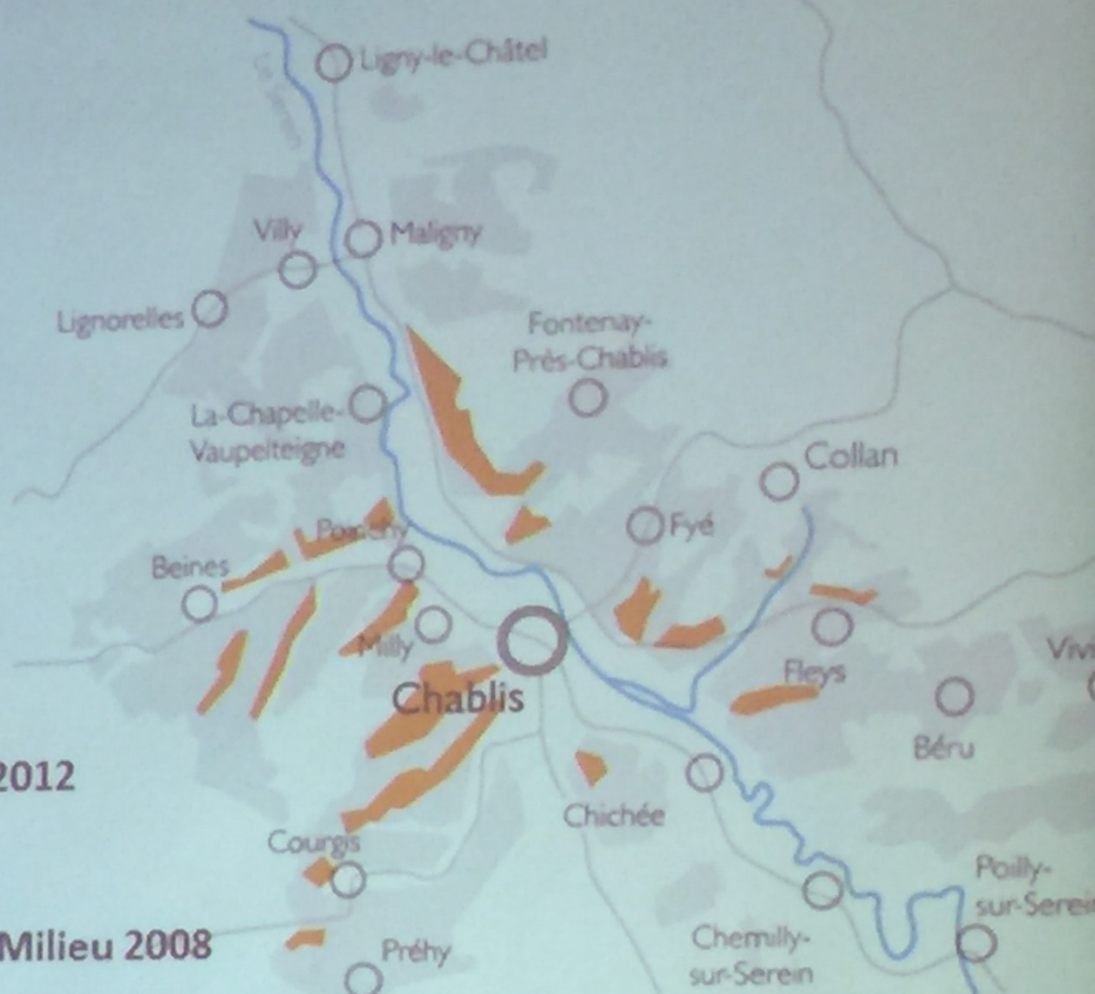
Il offre une large palette de vins et d'expressions qui séduisent un large public.

Le vignoble de Chablis c'est :

- un seul cépage, le Chardonnay
- un sous sol Kimmeridgien
- un savoir-faire acquis à travers des générations de vignerons
- 4 niveaux d'appellation
- 5400 ha
- 40 millions de bouteilles
- une présence dans près de 100 pays
- une pureté inimitable

CHABLIS

Appellation Chablis Premier Cru



Vin dégusté :
Chablis 1er Cru Vaillons 2012
et
Chablis 1er cru Mont de Milieu 2008

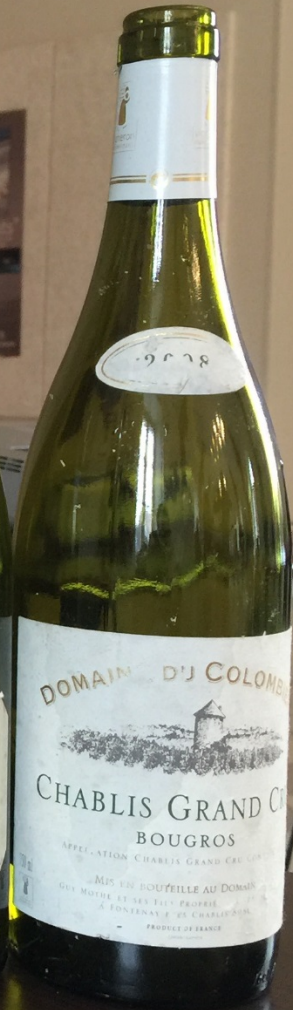
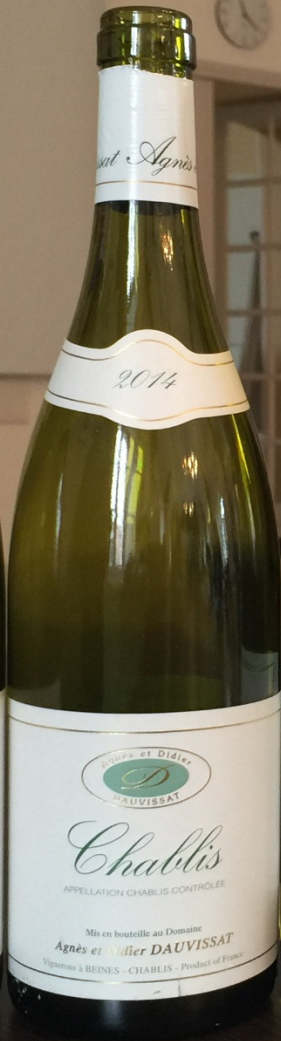
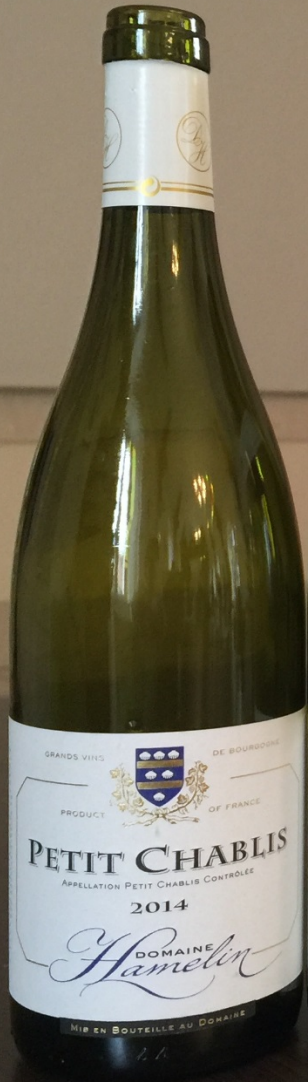
CHABLIS

Appellation Chablis Grand Cru

Décret de 1938
Sur les pentes abruptes de
la rive droite du Serein où
le Kimmeridgien affleure
par endroits
Exposition
principalement sud/sud
ouest

Orientation qui permet
d'être baignée par la
lumière du matin au soir
Elevage minimum
jusqu'au 15 mars de
l'année qui suit la récolte
1 Appellation Chablis
Grand Cru, 7 Climats





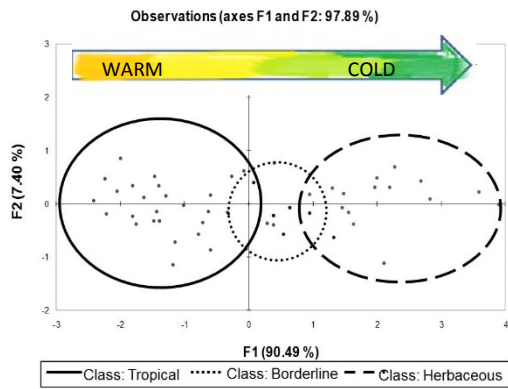








The holy grail of wine typicality?



Principal component analysis (Axes F1 & F2: 97.89%) of 52 Sauvignon Blanc Wines in the Western Cape Province of South Africa. The style of wine, in terms of intensity of tropical and/or green characteristics, seems mainly related to the thermal condition of the regions at the macroclimatic level (warm versus cool). At the bunch level (microclimate), light and temperature will therefore influence berry composition and the style of wine. Factor 1 (F1) indicated by the horizontal axis explains 90.49% of the variance in the data and factor 2 (F2) indicated by the vertical axis explains 7.40% of the variance in the data set.



macroclimate

microclimate

harvest dates



**Malmesbury
(Swartland)**



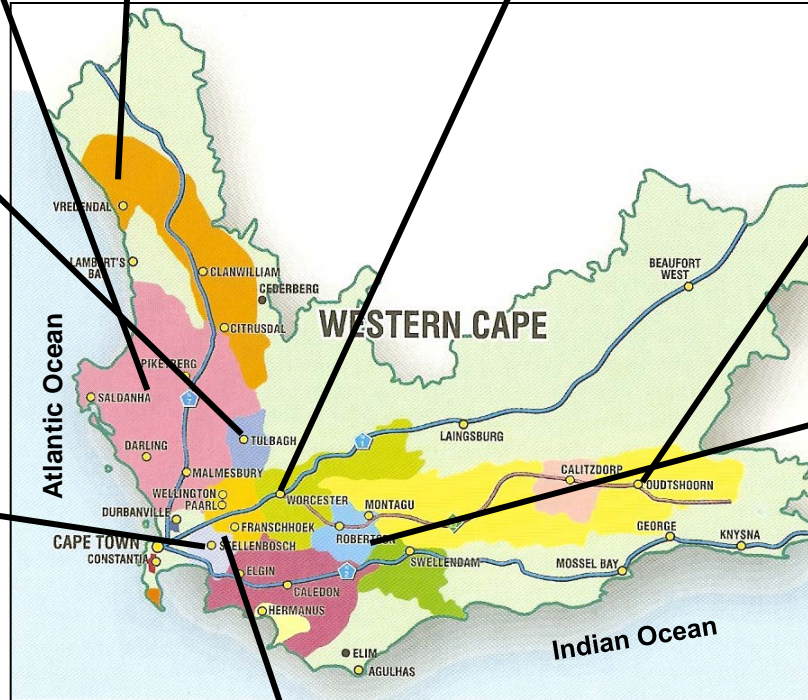
Olifants river



Worcester



Tulbagh



Little Karoo



Robertson



Stellenbosch

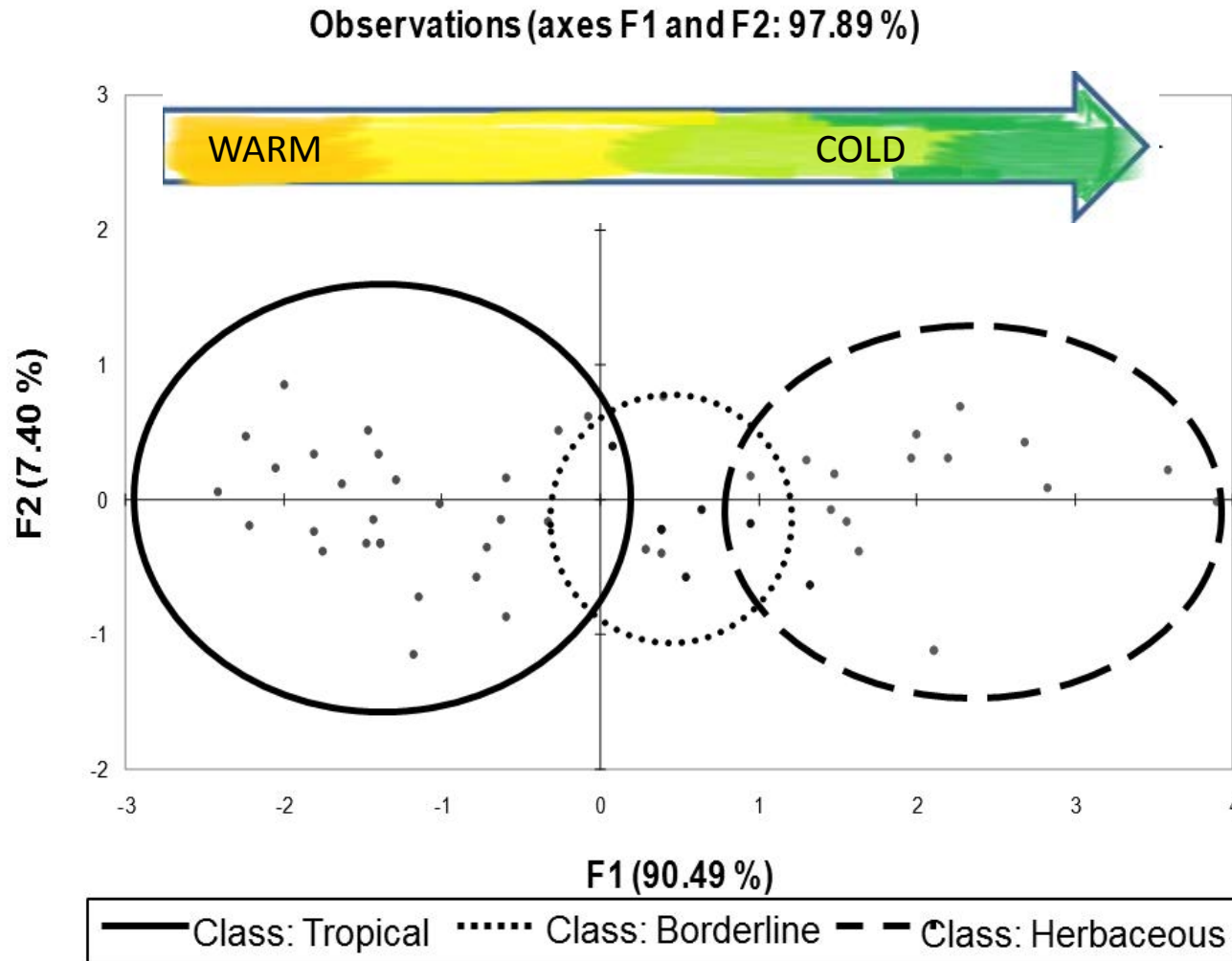


Paarl

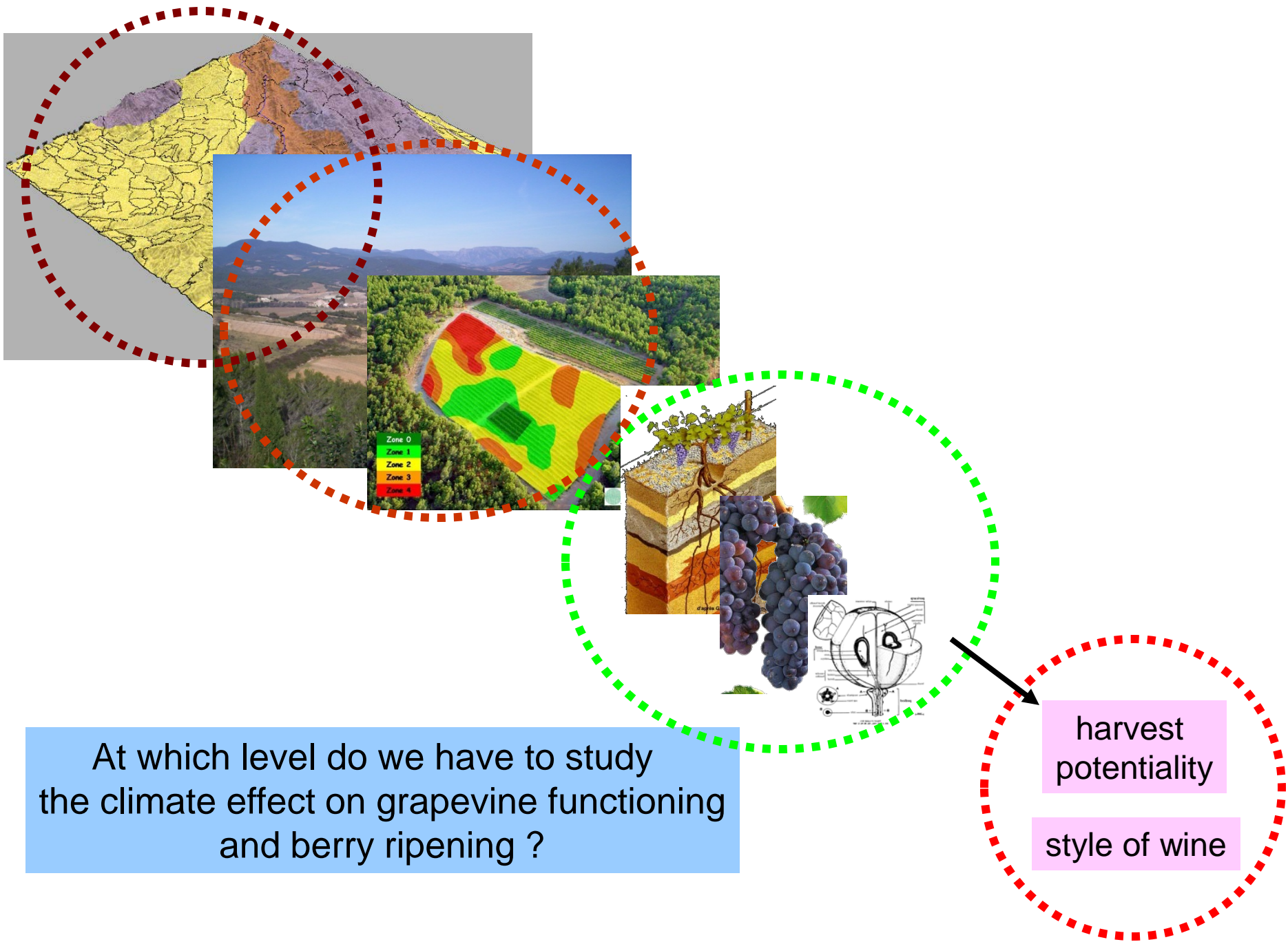


Franshoek

Climate: primary driving factor of berry ripening

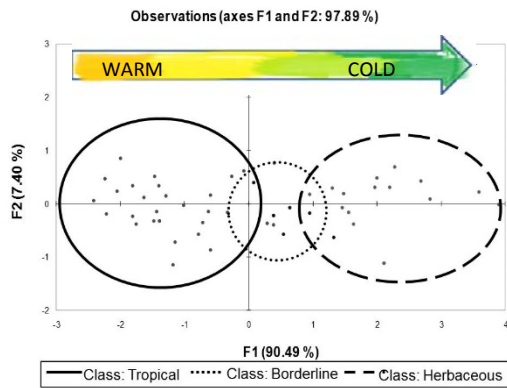


Principal component analysis (Axes F1 & F2: 97.89%) of 52 Sauvignon Blanc Wines in the Western Cape Province of South Africa. The style of wine, in terms of intensity of tropical and/or green characteristics, seems mainly related to the thermal condition of the regions at the macroclimatic level (warm versus cool). At the bunch level (microclimate), light and temperature will therefore influence berry composition and the style of wine. Factor 1 (F1) indicated by the horizontal axis explains 90.49% of the variance in the data and factor 2 (F2) indicated by the vertical axis explains 7.40% of the variance in the data set.



At which level do we have to study the climate effect on grapevine functioning and berry ripening ?

The holy grail of wine typicality?



Principal component analysis (Axes F1 & F2: 97.89%) of 52 Sauvignon Blanc Wines in the Western Cape Province of South Africa. The style of wine, in terms of intensity of tropical and/or green characteristics, seems mainly related to the thermal condition of the regions at the macroclimatic level (warm versus cool). At the bunch level (microclimate), light and temperature will therefore influence berry composition and the style of wine. Factor 1 (F1) indicated by the horizontal axis explains 90.49% of the variance in the data and factor 2 (F2) indicated by the vertical axis explains 7.40% of the variance in the data set.

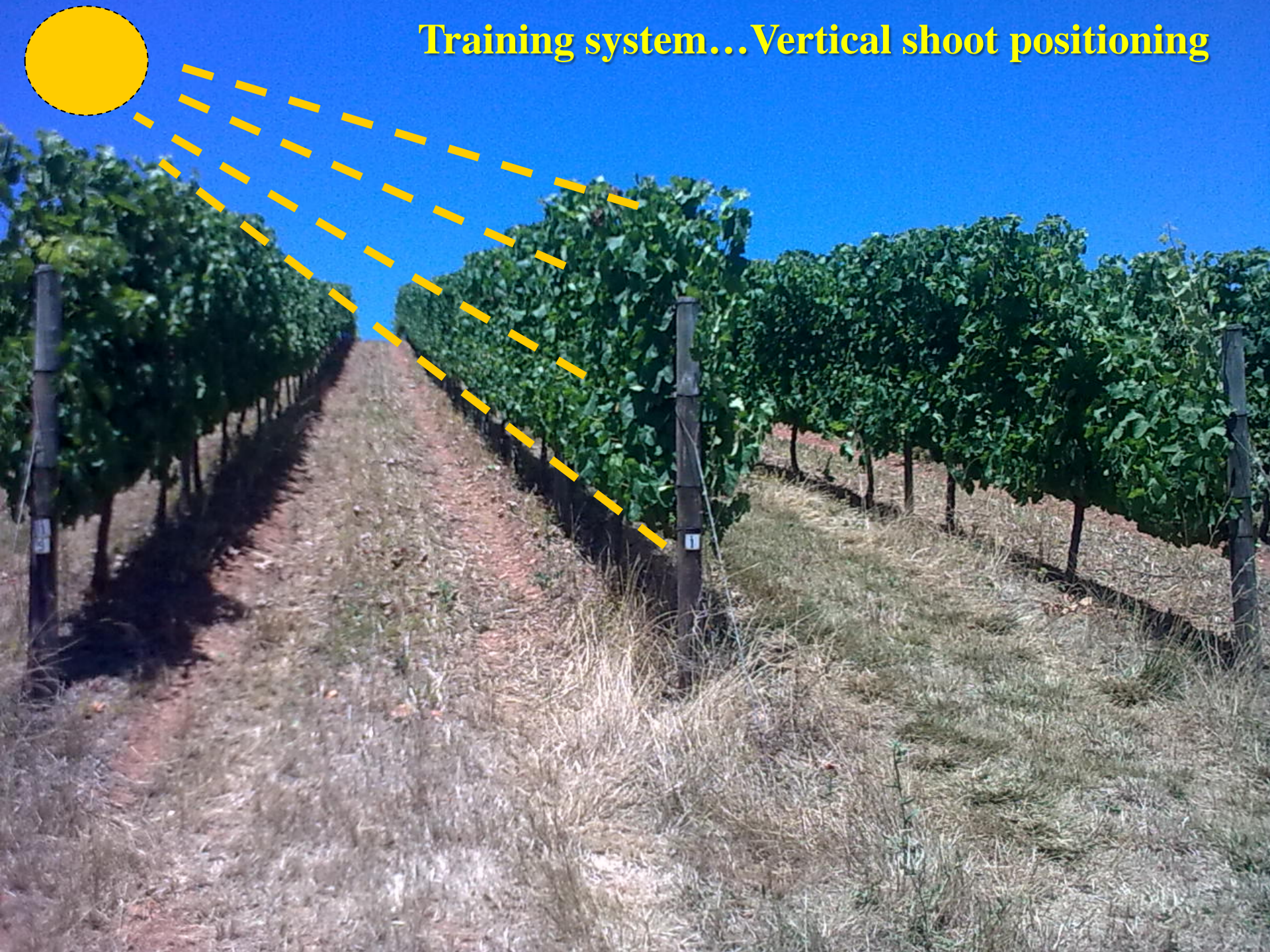


macroclimate

microclimate

harvest dates

Training system...Vertical shoot positioning





Gobelet
« échalassé »
(L'Ormarins)

Effect of canopy manipulation on abiotic factors and grape and wine composition of *Vitis vinifera* L. cv. Sauvignon Blanc

Deloire A., Šuklje K., Coetzee Z., Lisjak K., Antalick G.,
Brandt J.



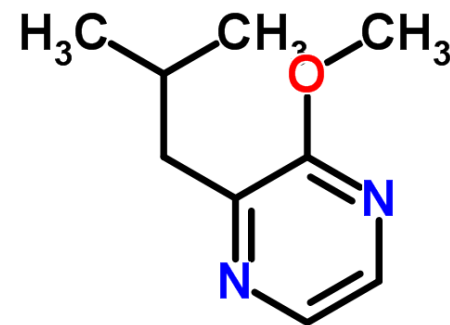
Institute for Wine Biotechnology, Department of Viticulture and Oenology,
Stellenbosch University, South Africa

Agricultural Institute of Slovenia, Central Laboratories, Slovenia



Methoxypyrazines

- IBMP (3-isobutyl-2-methoxypyrazine)
- IPMP (3-isopropyl-2-methoxypyrazine)
- MPsB (2-methoxy-3-sec-butylpyrazine)
(Augustyn *et. al.*, 1982)



- Sauvignon Blanc, Cabernet Sauvignon, Merlot, Cabernet franc, Carmenerere
- 0.5-2 ng/L in water, synthetic wine and white wine; 10-16 ng/L in red wines (Sala *et al*, 2004)



Thiols



4-methyl-4-sulfanylpentan-2-one (4MSP); 0.8 ng/L

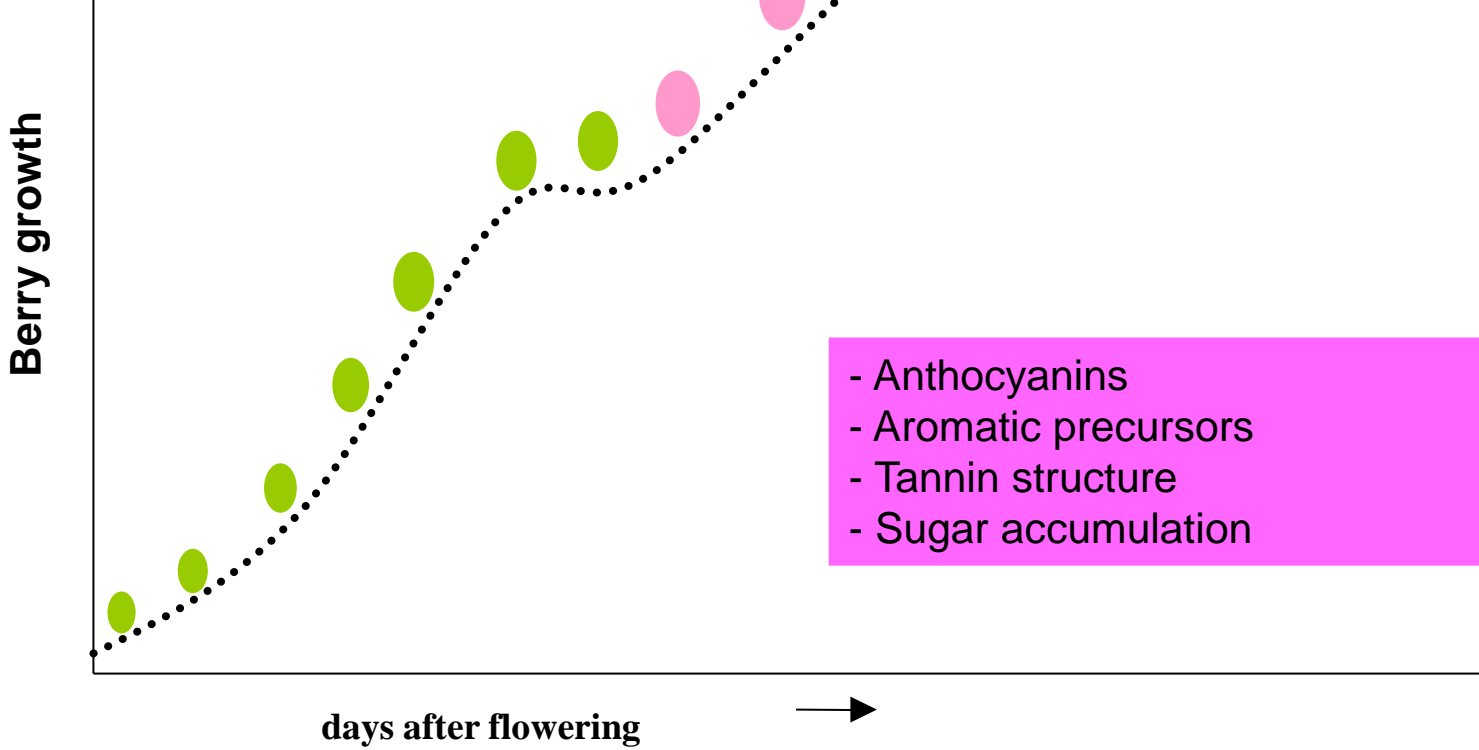
3-sulfanyl-hexylacetate (3SHA); 4 ng/L

3-sulfanylhexan-1-ol (3SH); 60 ng/L (Darriet *et al.*, 1995; Tominaga *et al.*, 1998; Dubourdieu *et al.*, 2006)



Berry composition

- Tannins
- Organic acids
- Aromatic precursors
- Pyrazines
- Polyamines
- Minerals accumulation
- Amino acids



- Anthocyanins
- Aromatic precursors
- Tannin structure
- Sugar accumulation

flowering

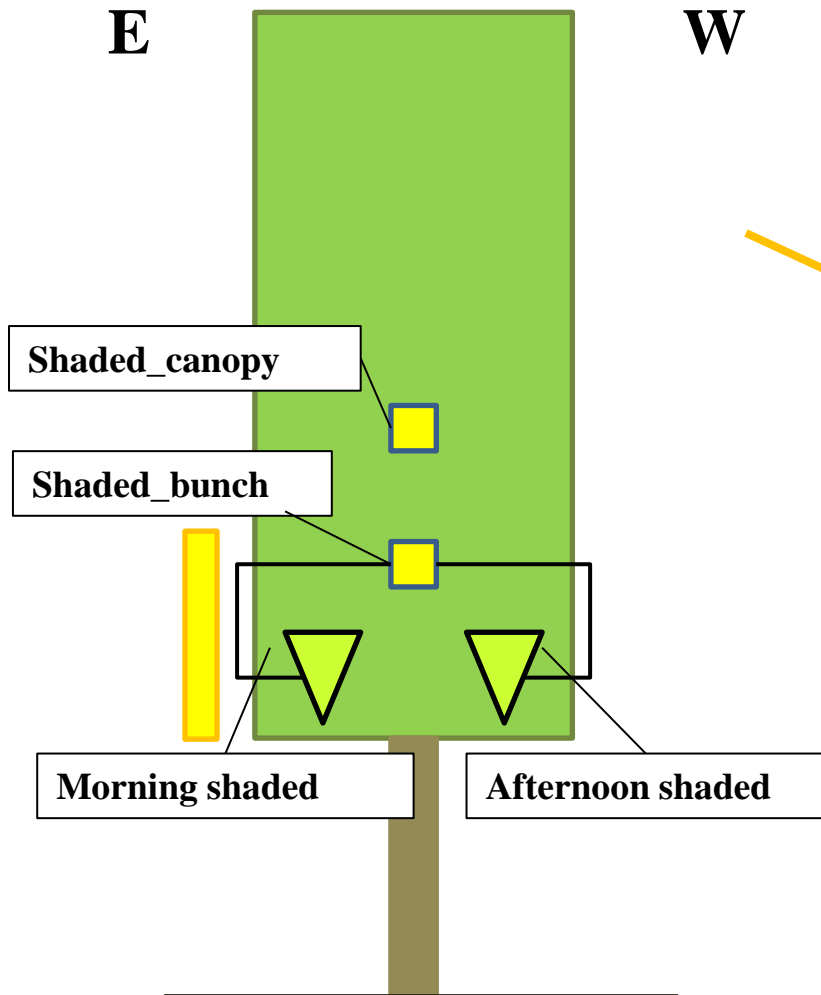
véraison

maturation

maturity
over ripeness

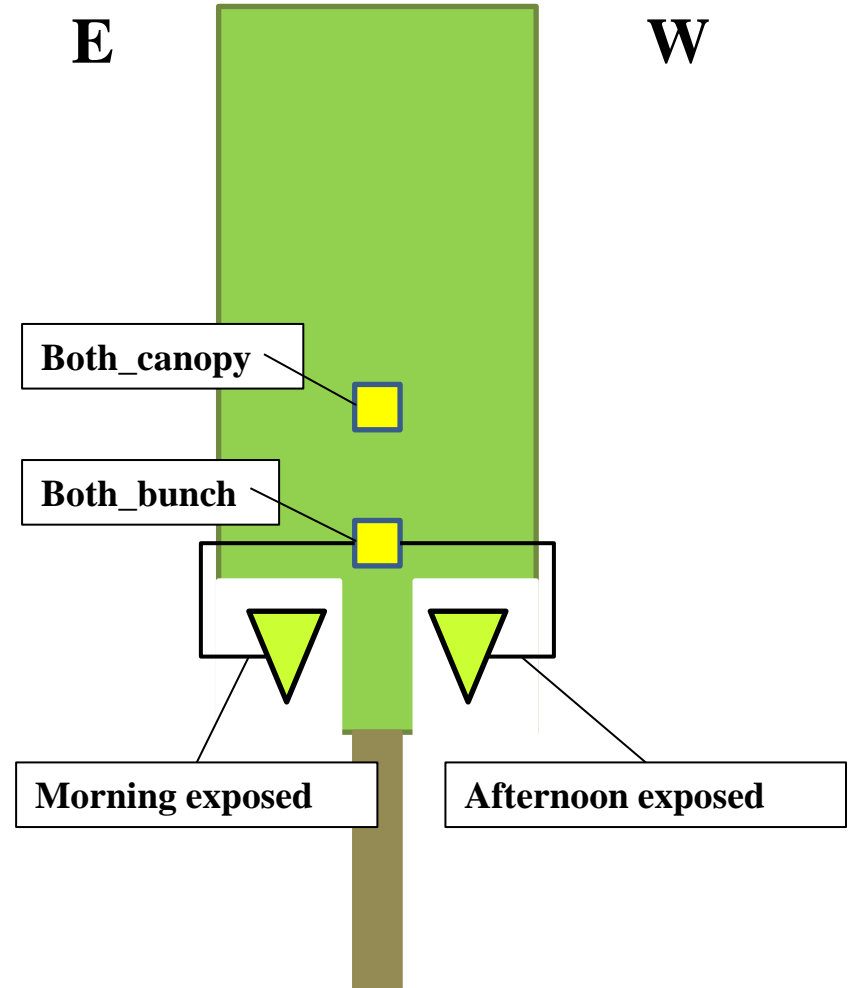
No leaf removal treatment-

UV
(C-UV)

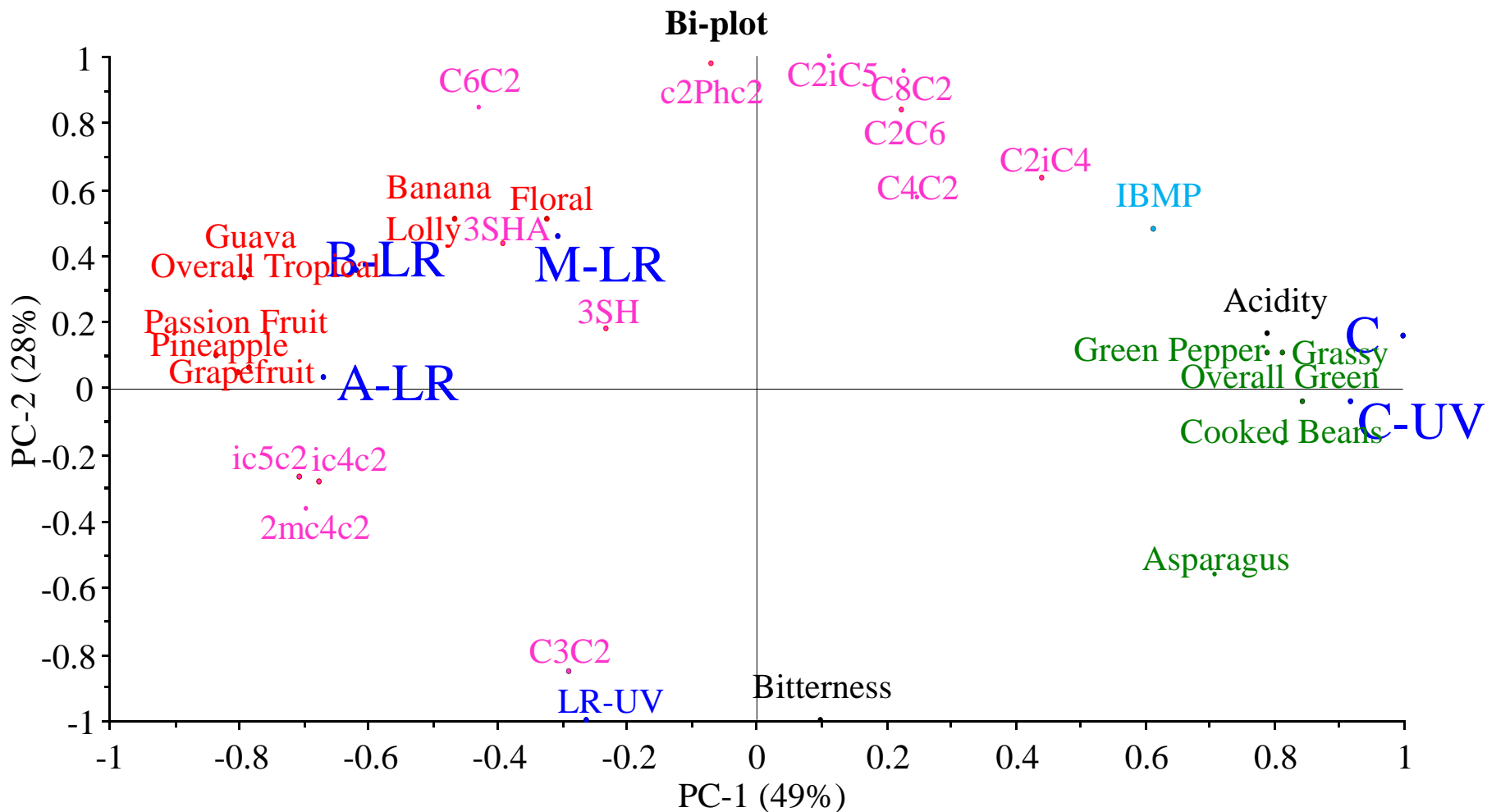




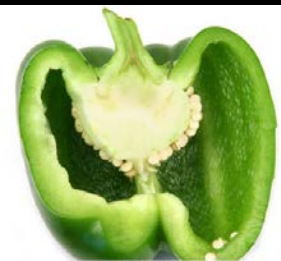
Both sides leaf removal (B-LR)



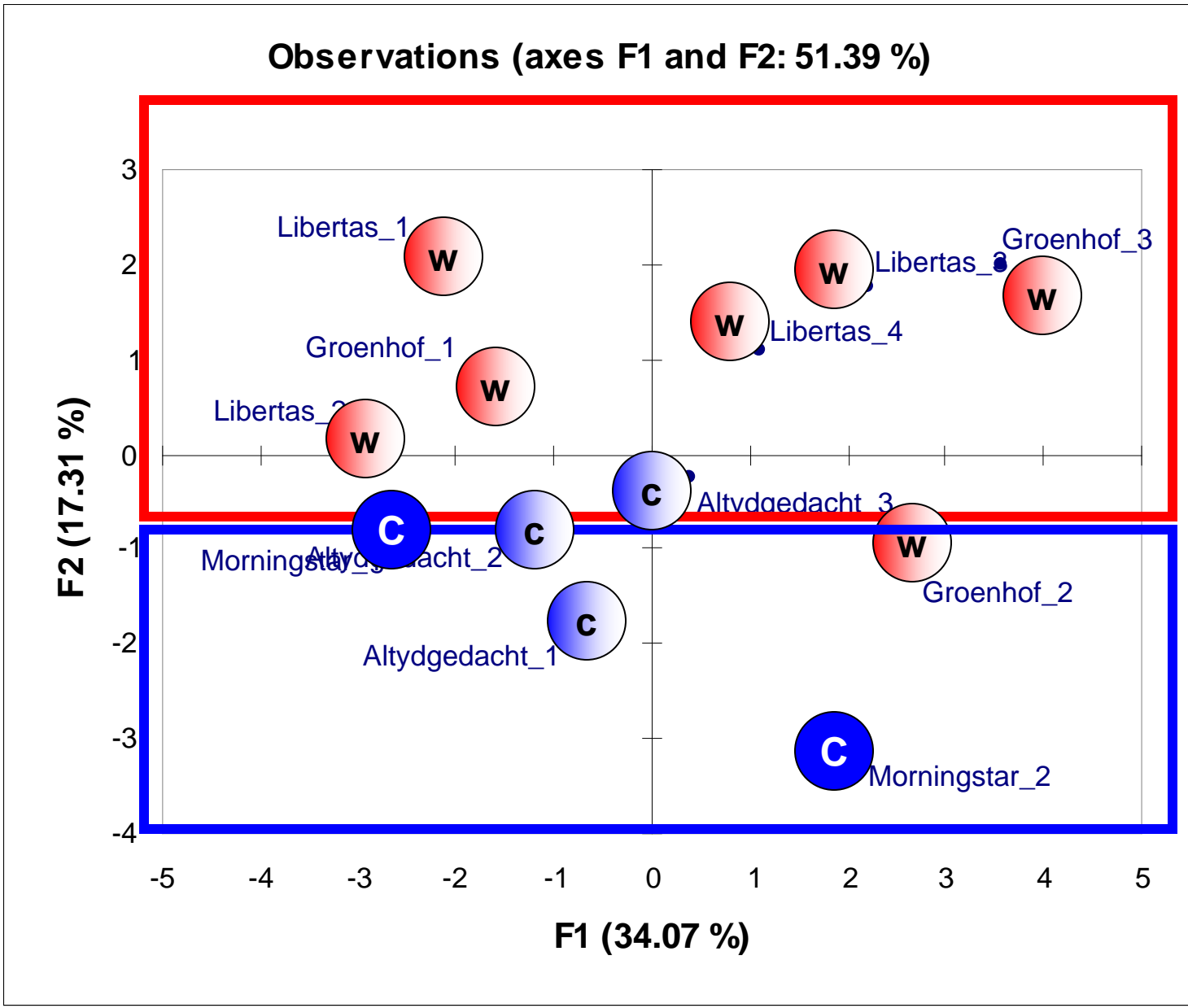
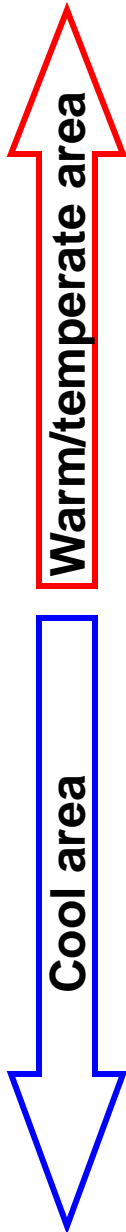
PCA Bi-Plot of Chemical and Sensory parameters



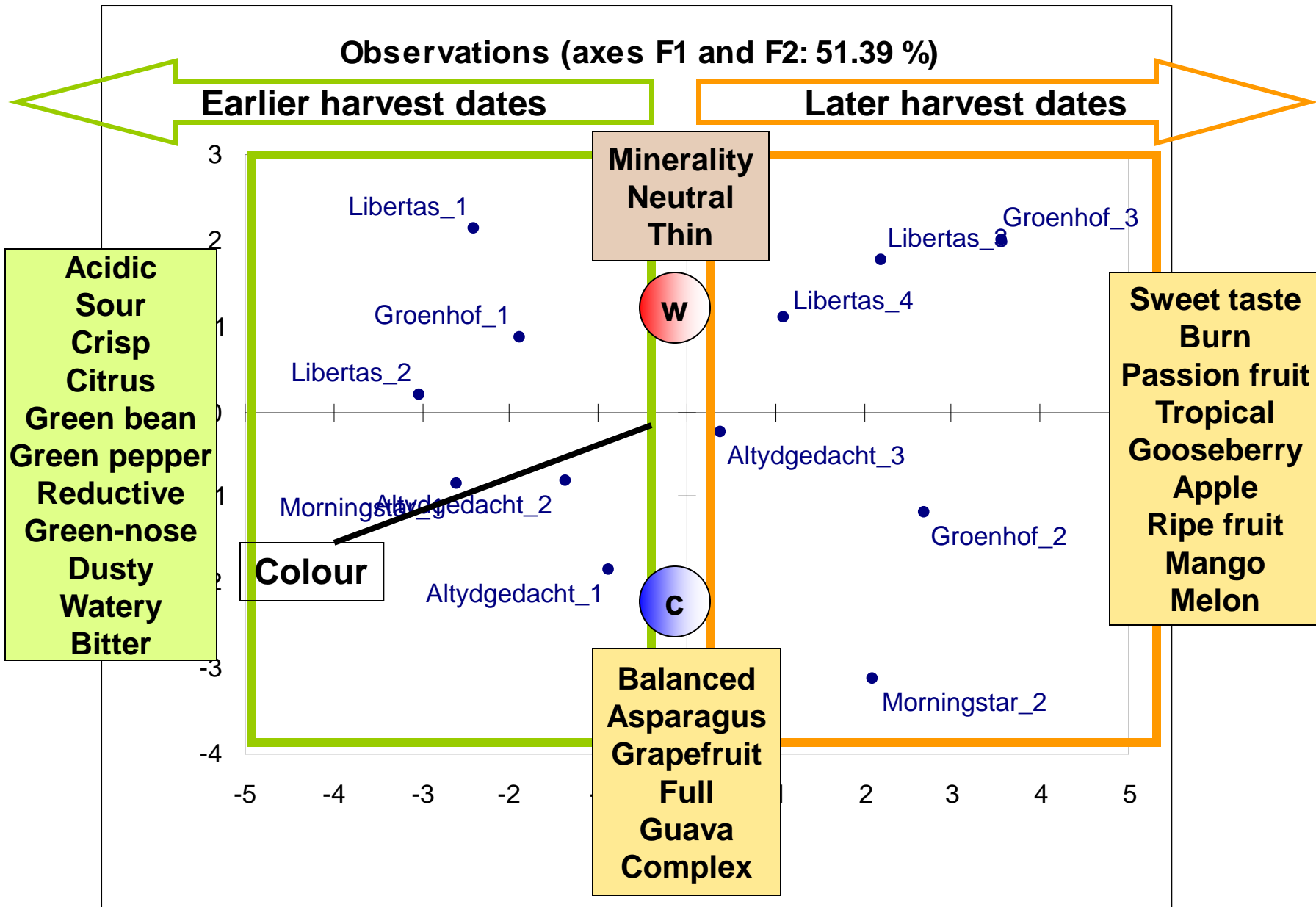
Napping[®] Results



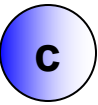
Sauvignon blanc



Sauvignon blanc



Altydgedacht1



Sauvignon blanc

Hue angle: 74
pH: 3.13
TA: 9.54
22.9°B

Hue angle: 76
pH: 3.09
TA: 10.86
20.7°B

Altydgedacht2



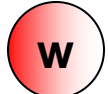
> 80 = green/asparagus/citrus/unripe
 < 80 and > 70 = tropical/grapefruit/citrus/boxtree
 < 70 = fermentative/neutral/terpene

Altydgedacht3



Hue angle: 72
pH: 3.16
TA: 9.17
22.8°B

Libertas1



Hue angle: 77
 pH: 2.86
 TA: 18.28
 18.6°B

Hue angle: 77
 pH: 3.02
 TA: 12.36
 19.2°B

Libertas2

Sauvignon blanc

> 80 = green/asparagus/citrus/unripe
 < 80 and > 70 = tropical/grapefruit/citrus/boxtree
 < 70 = fermentative/neutral/terpene



Hue angle: 75
 pH: 3.21
 TA: 8.38
 22.3°B

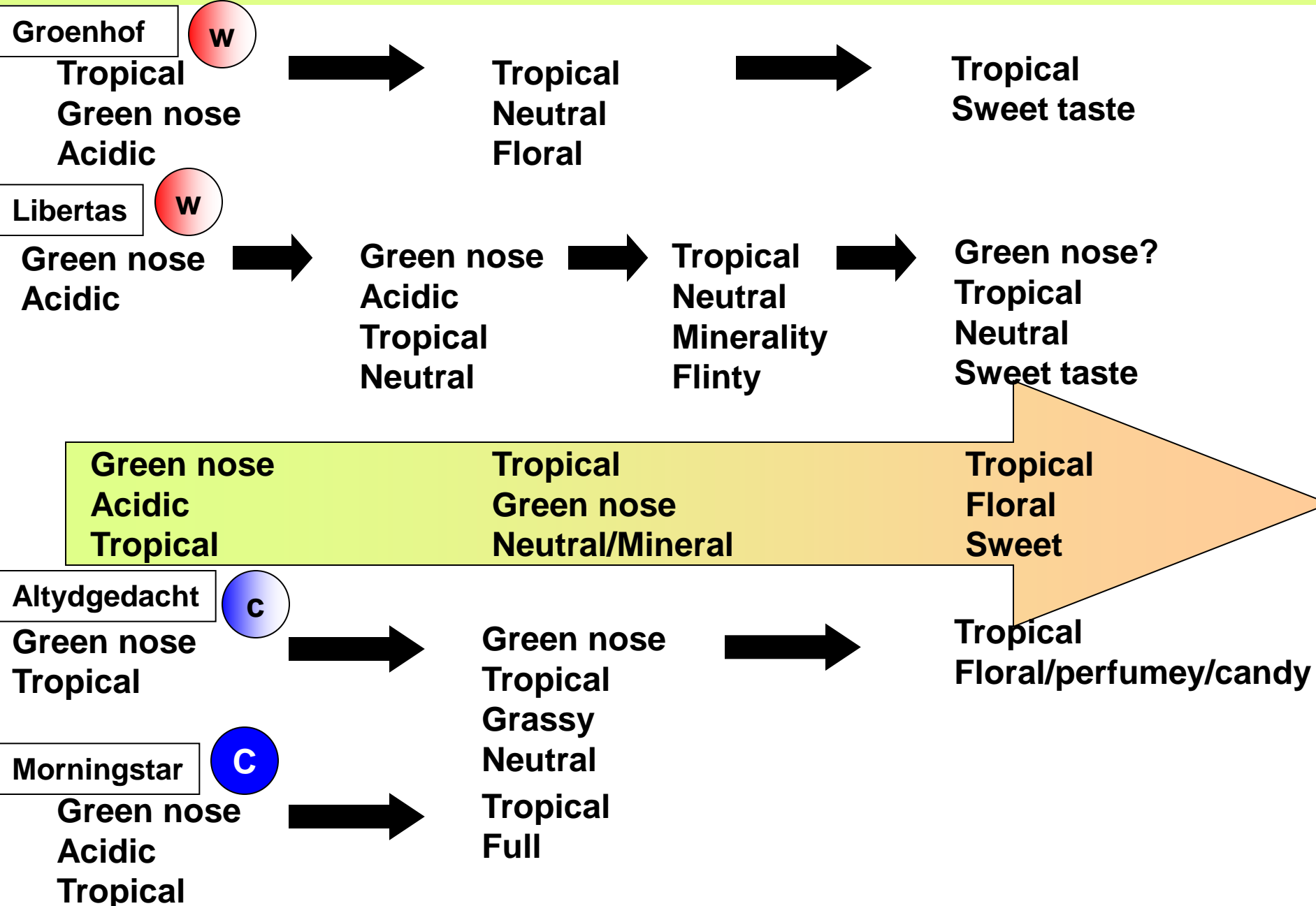
Libertas3

Libertas4

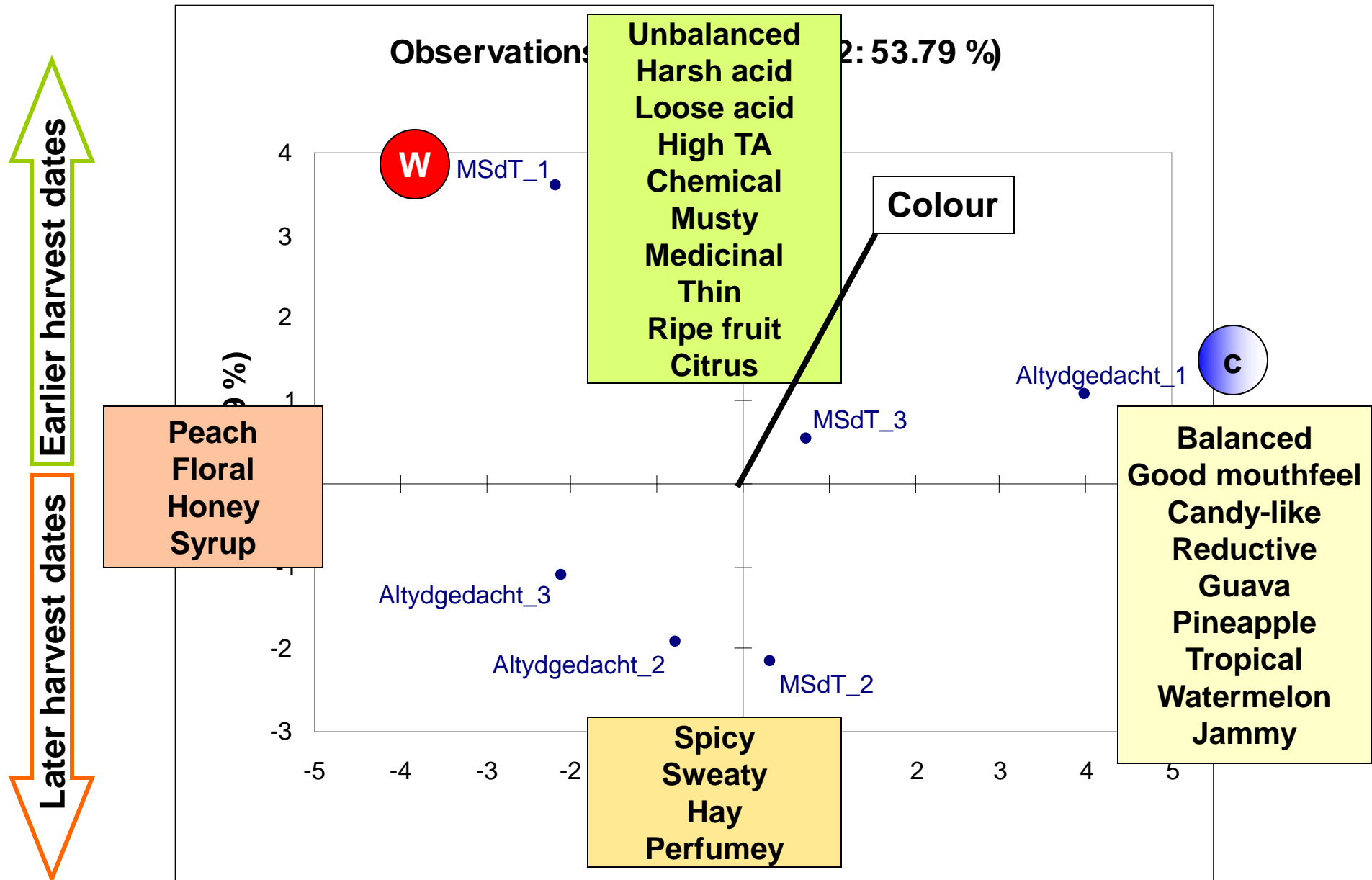
Hue angle: 72
 pH: 3.31
 TA: 7.25
 23.6°B



Sauvignon blanc Profile Progression



Chenin blanc



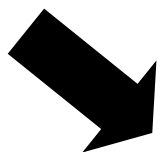
c Altydgedacht 1

Chenin blanc

Hue angle: 75
pH: 3.17
TA: 7.43
21.1 °B

Hue angle: 72
pH: 3.18
TA: 8.05
20.3 °B

tropical
citrus



Altydgedacht 2

green-apple
citrus
tropical



Altydgedacht 3

perfumey
citrus
tropical

Hue angle: 72
pH: 3.15
TA: 7.79
21.2 °B

> 80 = green/asparagus/citrus/unripe
< 80 and > 70 = tropical/grapefruit/citrus/boxtree
< 70 = fermentative/neutral/terpene

apple
green-apple
reductive
jammy
full
good-mouthfeel
big-wine
clean
balanced
hay
dull-mouthfeel
grassy
perfumey
flinty
SO2
good-TA
candy-like

green-apple
citrus
tropical
herbal
spicy
meduimbody
acidic
watery
crisp
SB-like
sweaty
apple
floral
SO2
ripe-fruit
easy-drinking
reductive
grassy
perfumey

apple
full
grassy
oxidative
spicy
citrus
high-alcohol
crisp
tropical
sweet-taste
fresh
bitter
honey
meduimbody
botrytis
raisins
acidic
roasted-almonds
floral
perfumey

W MSdT 1

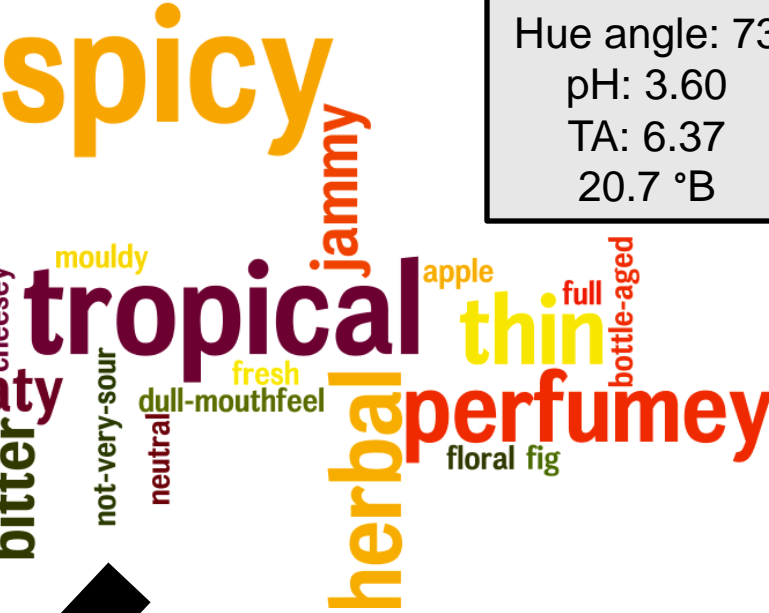
Hue angle: 75
pH: 3.11
TA: 12.29
14.2 °B

Chenin blanc



MSdT 2

Hue angle: 73
pH: 3.60
TA: 6.37
20.7 °B



> 80 = green/asparagus/citrus/unripe
 < 80 and > 70 = tropical/grapefruit/citrus/boxtree
 < 70 = fermentative/neutral/terpene

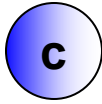
MSdT 3

Hue angle: 74
pH: 3.48
TA: 6.10
21.3°B



Chenin blanc Profile Progression

Altydgedacht



Tropical
Citrus



Citrus
Green apple
Tropical
Grassy
Perfumey



Perfumey
Spicy
Citrus
Tropical
Bitter
Grassy

Tropical
Citrus

Green apple
Grassy

Perfumey
Spicy

MSdT



Acidic
Tropical
Thin



Spicy
Herbal
Tropical
Perfumey

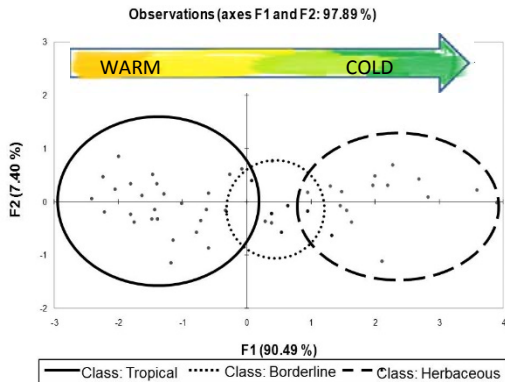


Tropical
Neutral
Perfumey

The holy grail of wine typicality?



A French example: Chablis



Principal component analysis (Axes F1 & F2: 97.89%) of 52 Sauvignon Blanc Wines in the Western Cape Province of South Africa. The style of wine, in terms of intensity of tropical and/or green characteristics, seems mainly related to the thermal condition of the regions at the macroclimatic level (warm versus cool). At the bunch level (microclimate), light and temperature will therefore influence berry composition and the style of wine. Factor 1 (F1) indicated by the horizontal axis explains 90.49% of the variance in the data and factor 2 (F2) indicated by the vertical axis explains 7.40% of the variance in the data set.



macroclimate

microclimate

harvest dates

Product typicality

“The **typicality** of an **agricultural product** is its property of belonging to a **distinct type** and identified by a **reference group** of individuals whose **know-how** is distributed throughout the sector, i.e. **knowing how to:**

- **establish,**
- **produce,**
- **evaluate**
- **and appreciate.**

*This property should not be confused with conformity to a norm; quite the contrary, it accepts **variety within the type.***

If it is supposed that **typicality corresponds to an agreed taste**, three different **production strategies** could be envisaged:

a) the **typicality is revealed**, in which case **oenological processes are adapted to the revelation of the dominant harvest potential**, and here, “terroir” effect includes **vintage variability**;

b) the **typicality is “constructed”**, in which case the **potentialities of different grape are identified**, the grapes are fermented separately or together and then the wine is blended to obtain a style corresponding to **a target category**;

c) the **typicality is adapted to market demand**, in which case oenological techniques are tailored to the harvest potential to obtain a product that immediately **responds to market demand** (the industrial approach to winemaking: *coffee Pinotage, citrus Chardonnay, green Sauvignon blanc*).

Thanks you for your attention

