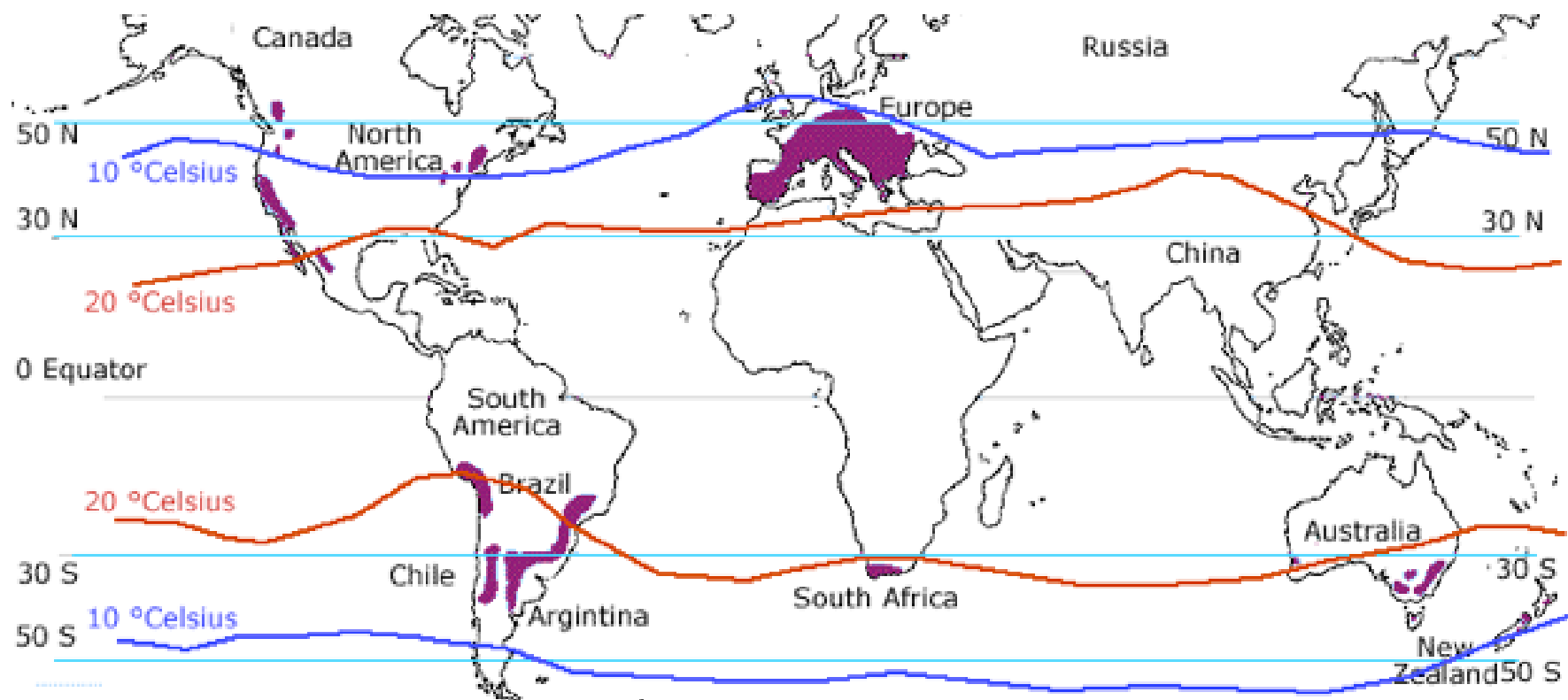
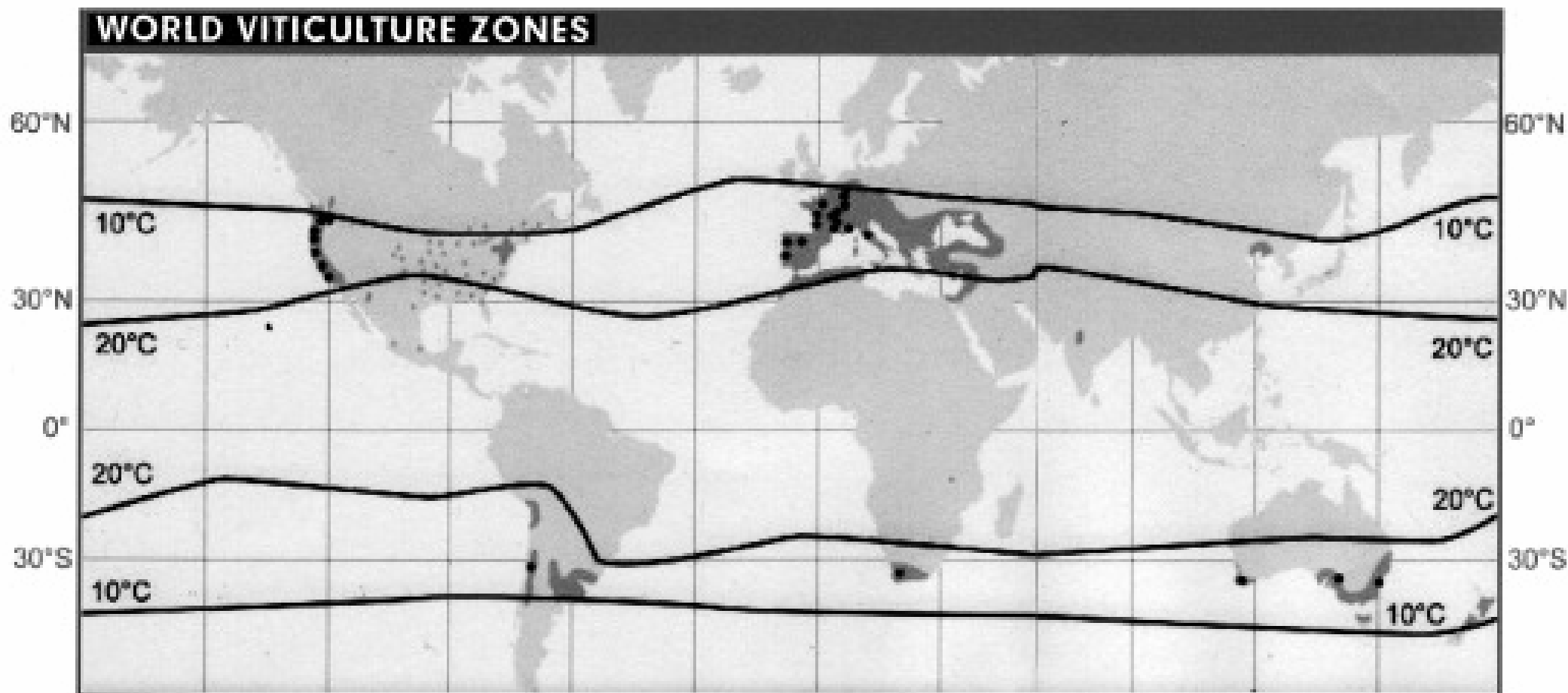


Current Viticulture Practices in Wine Grape Growing in India: Issues and Challenges with Reference to Processing







The world's major viticulture regions fall into bands of areas, with average temperatures between 10 and 20 °C giving a good spatial proxy for the limits of grape and wine production. The dots on the map represent the wine regions studied in a global analysis by Gregory James and colleagues on the impacts of climate change on wine quality.



Grape growing regions in India

Varieties

- **Global Scenario**

- Over 10,000 documented varieties within the sub-species *Vitis vinifera* (the "European" or "true" wine grapes).

- **Red wine grape varieties**

Cabernet Sauvignon

Merlot

Syrah/Shiraz

Malbec

Zinfandel

Tannat

Cabernet Franc

Petite SirahCarignan

Pinotage

Tempranillo

White wine grape varieties

Chenin Blanc

Sauvignon Blanc

Chardonnay

Ugni Blanc/Trebbiano

Pinot Blanc

Pinot Gris

Riesling

Semillon

Viognier

Juicy: the characteristics of wine grape berry





**Wine produced
in vineyards**



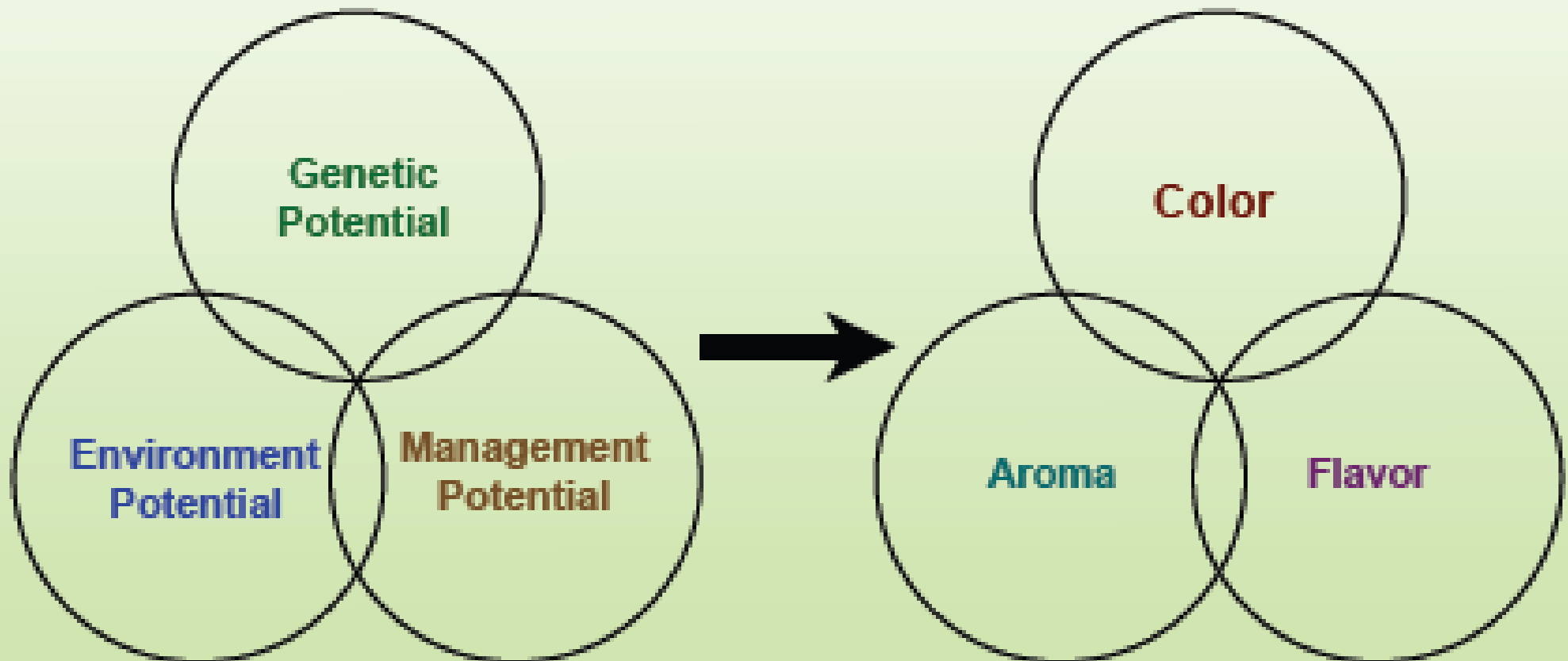
Flavour & Character Requirements

The Winegrape Quality Triangle

Vineyards & Grape Quality

Vineyard Factors

Wine Grape Quality Factors



Factors affect wine quality

Soil

Minerality

Nutrients

Water quality and quantity

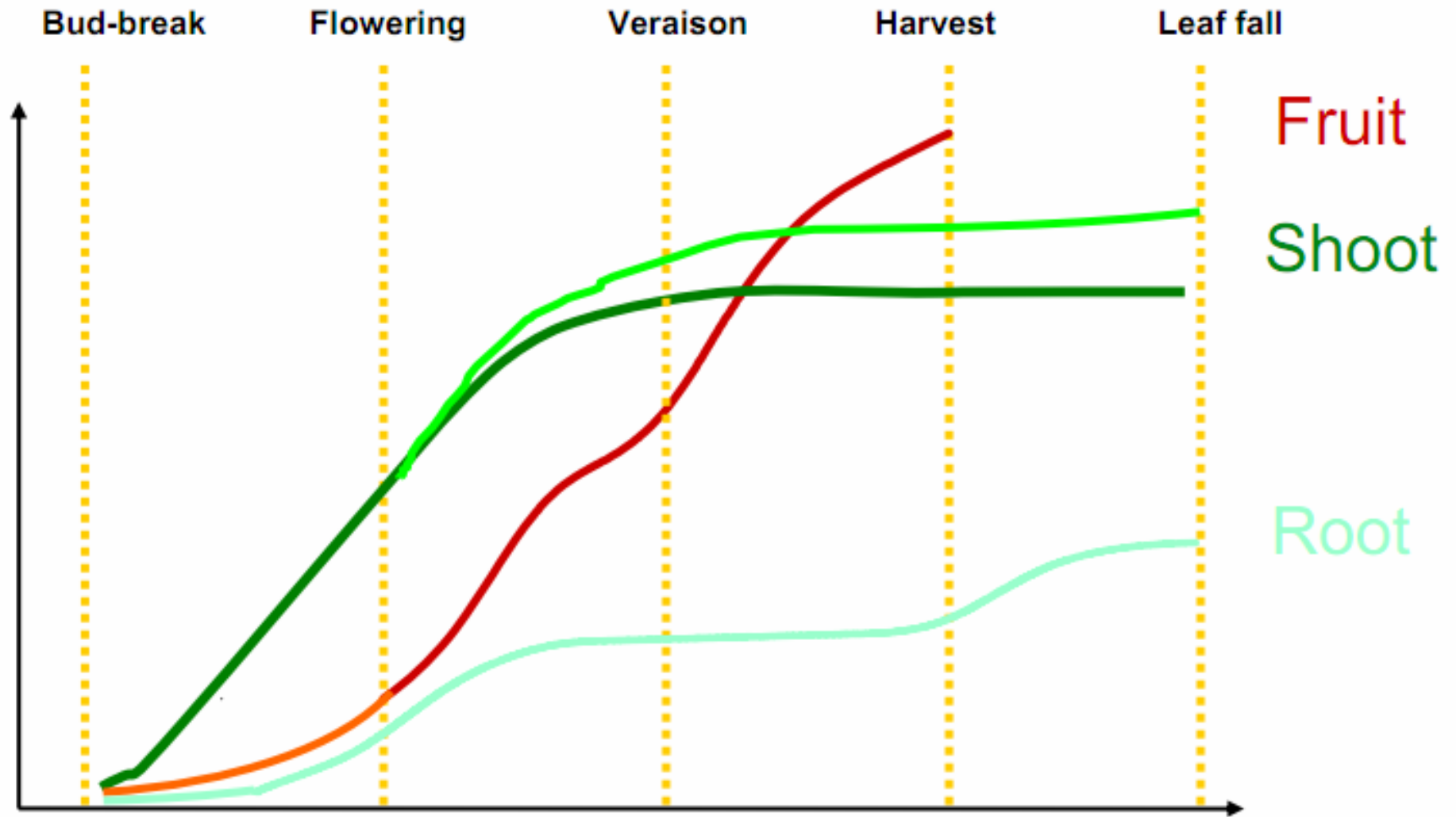
Climatic conditions

Bunch load

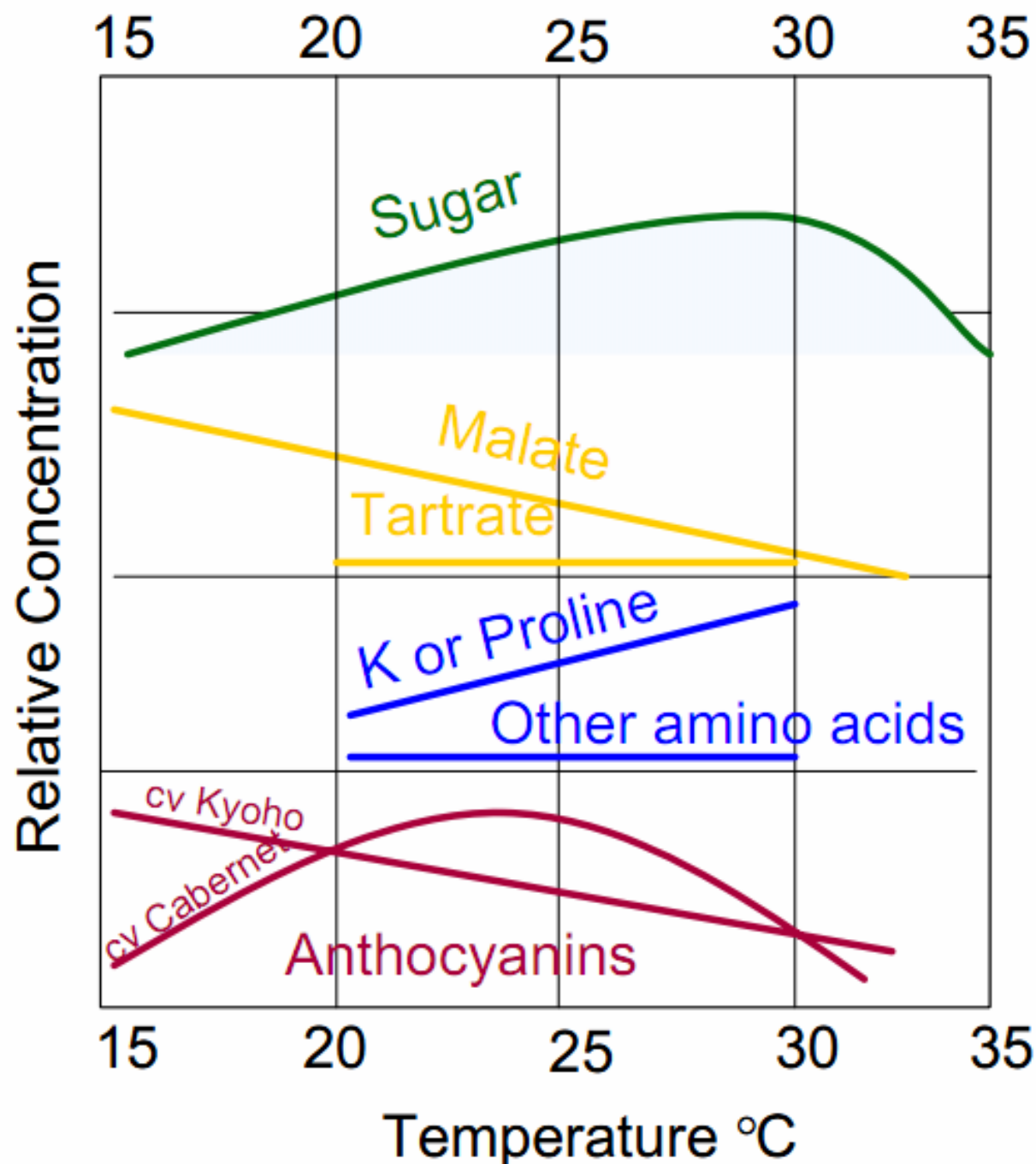
Berry size

Drying of berries on vines

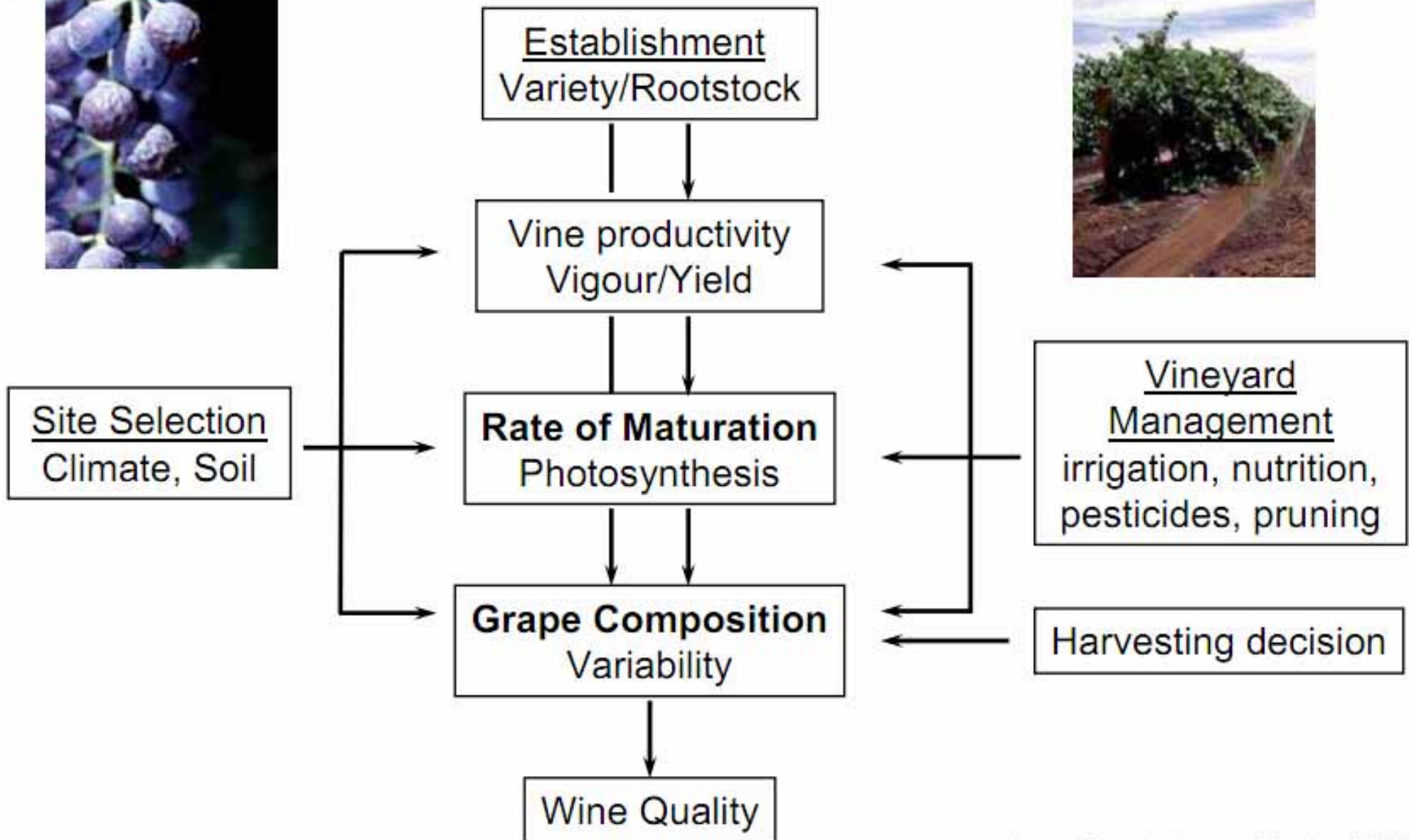
Vine phenology and growth



Influence of temperature on grape composition



Effect of vineyard environment and management on grape maturation and composition



Establishment of vineyard on Y system



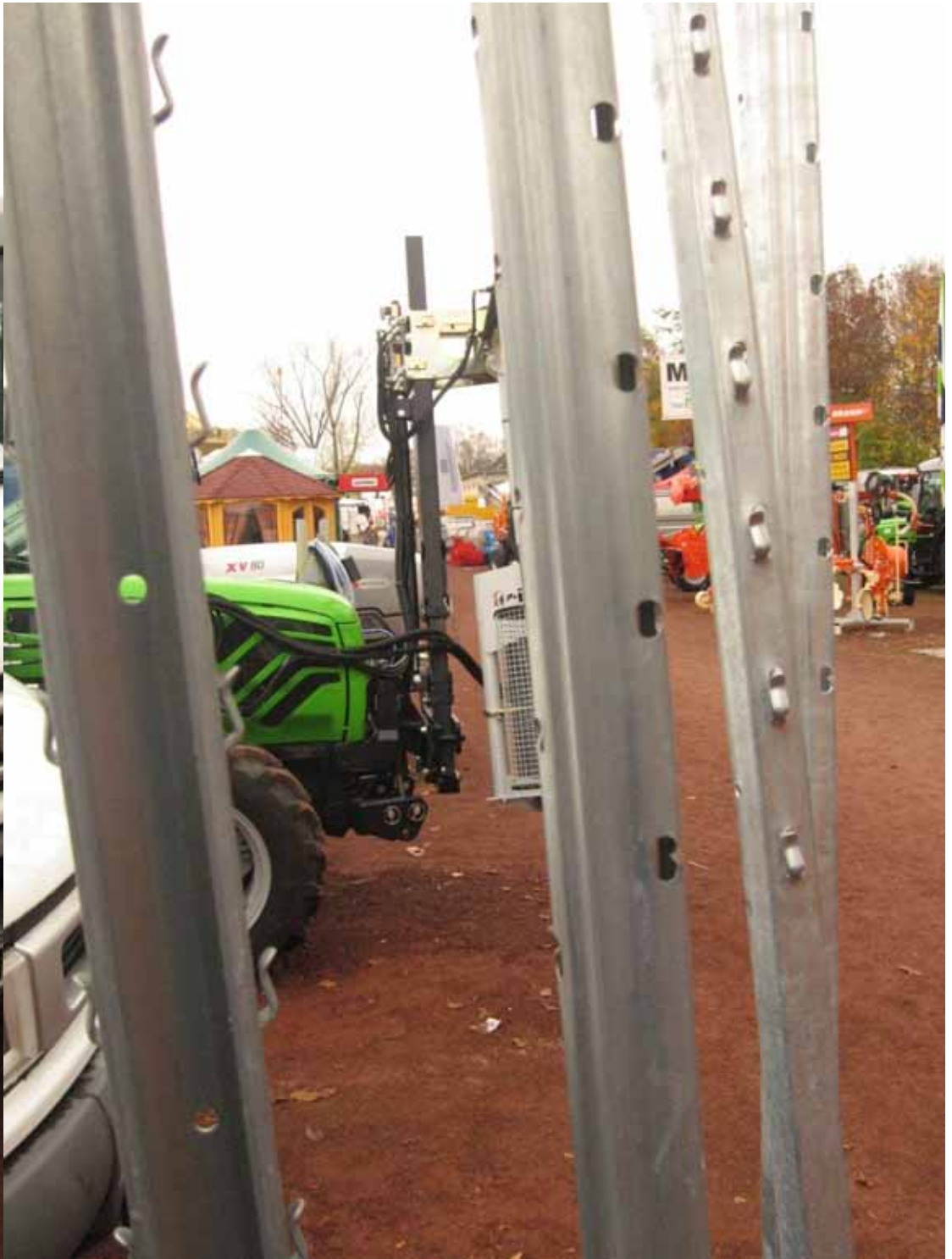
Canopy on Y System : Mechanization ?



Canopy on VSP system: Suitable for Mechanization



Material for Training System: Select as per suitability



Common fruit characteristics of over cropped vines

- **Low soluble solids**
- **Low acidity**
- **High acidity**
- **Poor colour**
- **Susceptibility to sunburn**

Common fruit characteristics of under cropped vines

- **Vegetative and undesirable flavours**
- **High pH**
- **Poor colour**



Balanced bunch load

Water stress

- Grapes cultivated under mild water stress can improve berry composition (Matthews *et al.*, 1990; Smart *et al.*, 1990)
- Can impact wine sensory attributes
- Water stress can also have many negative consequences
 - reduced yields (Smart *et al.*, 1974)
 - diminished winter hardiness
 - delayed maturity (Pool and Lakso, 2001).
- Therefore, water stress could be a negative determinant of *terroir*.

Water status and vine size

- Many relationships found from vintage from vintage across vineyards studied
- Site specific in terms of the relationship
- Some negatively correlated
 - Lower water status, bigger vines
 - Larger canopy, more evaporative demand
- Some positively correlated
 - Higher water status, bigger vines
 - Less stress more vegetative growth
- Timing of water stress comes into play
- May need to be further investigated

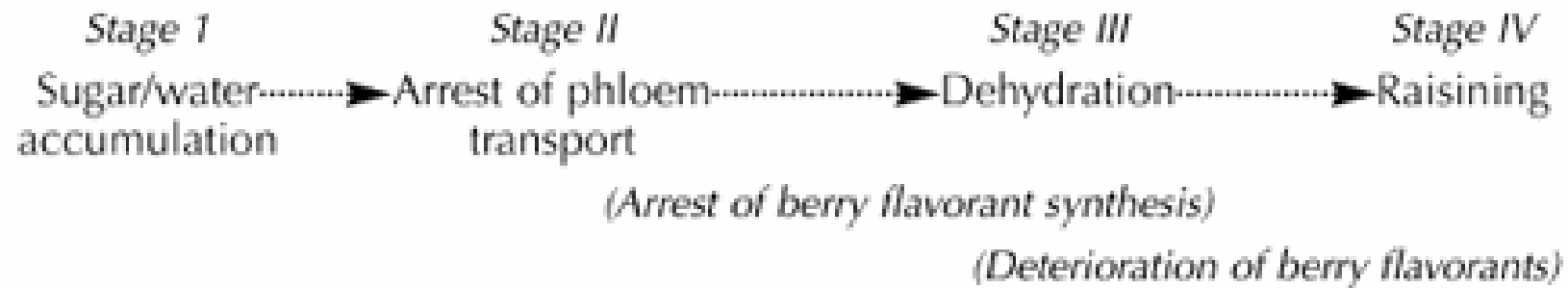
Regulated Deficit Irrigation (RDI) to save water and improve Sauvignon Blanc quality? (Greven et al. 2005)

- **Water use in Sauvignon Blanc grapes, could be reduced by 40% without causing differences in yield or quality parameters.**
- **In an area like Marlborough where irrigation is additional rather than essential, seasonal differences are likely to be greater than irrigation treatment differences.**
- **Cutting the amount of irrigation reduced leaf area but none of the yield parameters.**
- **Reduction came from both a reduced leaf growth as well as earlier senescence.**
- **Stem sap flow measurements were found to accurately reflecting the vine canopy size and transpiration.**

Stages of berry development



Stages of veraison



Stages of grape maturation

Uneven ripening

- Uneven ripening can present as bunches that contain small hard berries that remain green while other berries ripen. Bunches may have poor or uneven colouring.
- Unripe berries can lead to wines that are out of balance, with undesirable flavours, aromas and poor colour.

Predisposing elements (causes for loss)

- Harvesting too early before the bunches have reached their full maturity.
- Producing excessive crop that is too high for the functioning leaf area.
- Unfavourable weather conditions during flowering
- High variability within a harvest unit.

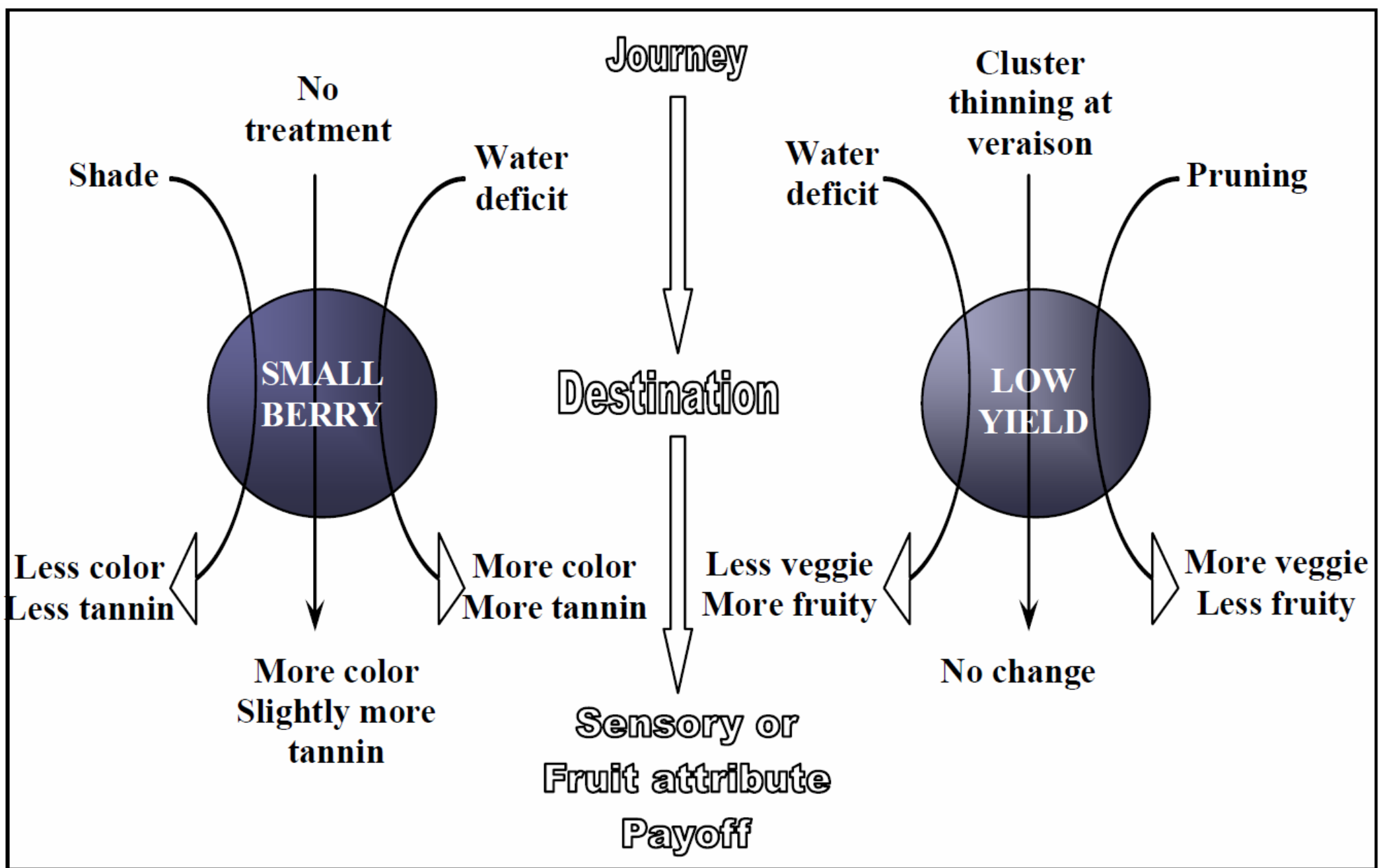
Even Ripened Berries



Varietal integrity: Presence of varieties other than the one expected to be in the load is not tolerated by wineries

Loss or risk potential

- It is detrimental to wine quality when the desired flavours and aromas are altered through the mixing of varieties.
- Unwanted colour effects can occur in whites where red grape berries are present.
- Label integrity is affected if a greater amount than the allowable percentage has been mixed, thus damaging the winery's reputation in the market.
- The presence of malvidin diglucoside components, being an indicator of hybrid grapes (non-vinifera), is not acceptable in wine destined for the European markets.



A schematic representation of the effect of some treatments which produce Small berries and or low yield on sensory and fruit attribute payoff

International Network in Precision Viticulture



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The goals of this website are :

- ▶ to present the current tools and methods being used in precision viticulture,
- ▶ to provide some useful tools and links for the users,
- ▶ to share knowledge and within field data,
- ▶ to gather and share experience and information on precision viticulture at an international scale

[References](#)

[Events](#)

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Precision viticulture (PV)

- Grape yield maps are of fundamental importance for the development of PV
- A range of sources of spatial data (yield mapping, remote sensing, digital elevation models),

Spatial Aspects of Vineyard Management and Wine Grape Production

Some comments of Roberts, 1999:

- Site selection is the most important decision in wine quality.
- Developing the site to its potential requires thorough knowledge of soil & climate, and spatial variables.
- A soil classification system can be used for comparing sites, and for choosing rootstocks and vine spacing.
- Influence of soil & climate interaction with the vines varies spatially.
- Climatic conditions, soil characteristics, topography, water availability are examples of interactive natural factors that vary spatially; management of irrigation, fertilisers, and crop load are examples of controllable factors that vary spatially.
- The proof of wine quality is in the bottle. The reasons for quality may be explored in the spatial information system.

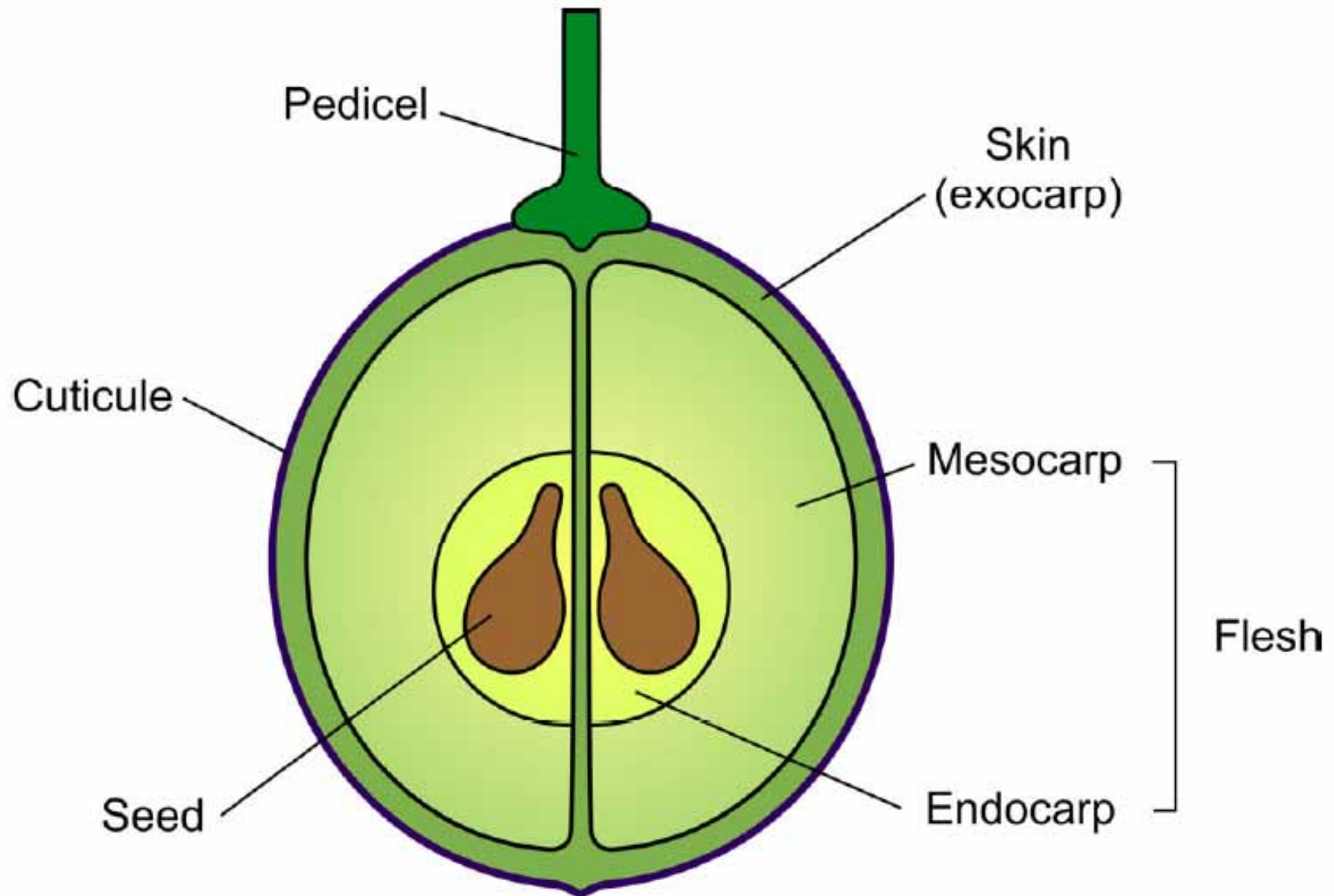
Soil profile knowledge for spatial aspects



Precision Crop Monitoring using Unmanned Ground Vehicles



Structure of a ripe grape berry



Maturity standards

- **White varieties:** TSS (°Brix)

Acidity

Juice recovery

Wine yield

- **Red varieties:** Above parameters including Colour

Sensory assessment of berries

- Berries tasting for sensory assessment
- The tasting includes berry firmness, colour, stalk removal, sweetness, acidity, juicing, skin strength, acidic, aroma, herbaceous, seed colour, seed number etc.

Harvesting methods

- **Hand picking** :More selective and qualitative
- **Mechanical** :Considerable hourly crop volume(4-10t/hr)
Harvest is partially destemmed and crushed



Manual Harvesting: Best practice for quality wines

Grape Harvesters



Sugar reduction in juice

- **Govts. In European countries are pressurizing for making of wines with low alcohol content**
- **Some members of OIV want only 2% alcohol in wines**
- **Wines without alcohol are also available in market with compromise on quality parameters**

- **Development of new prototypes to reduce sugar in juice**
- **Prototype has two type filters viz. ultra and nano separately**
- **UF allows sugar, acid and water and removes proteins, phenolics, heavy molecules**
- **In NF sugar and some proteins blocked and it allows water and acid only**
- **In next step filtrate of NF and suspended material blocked by UF mixed and juice ready without sugars**
- **As per requirement of alcohol in wines, the sugar added from available sugar**

Alternative packaging and closures for wines

Closures

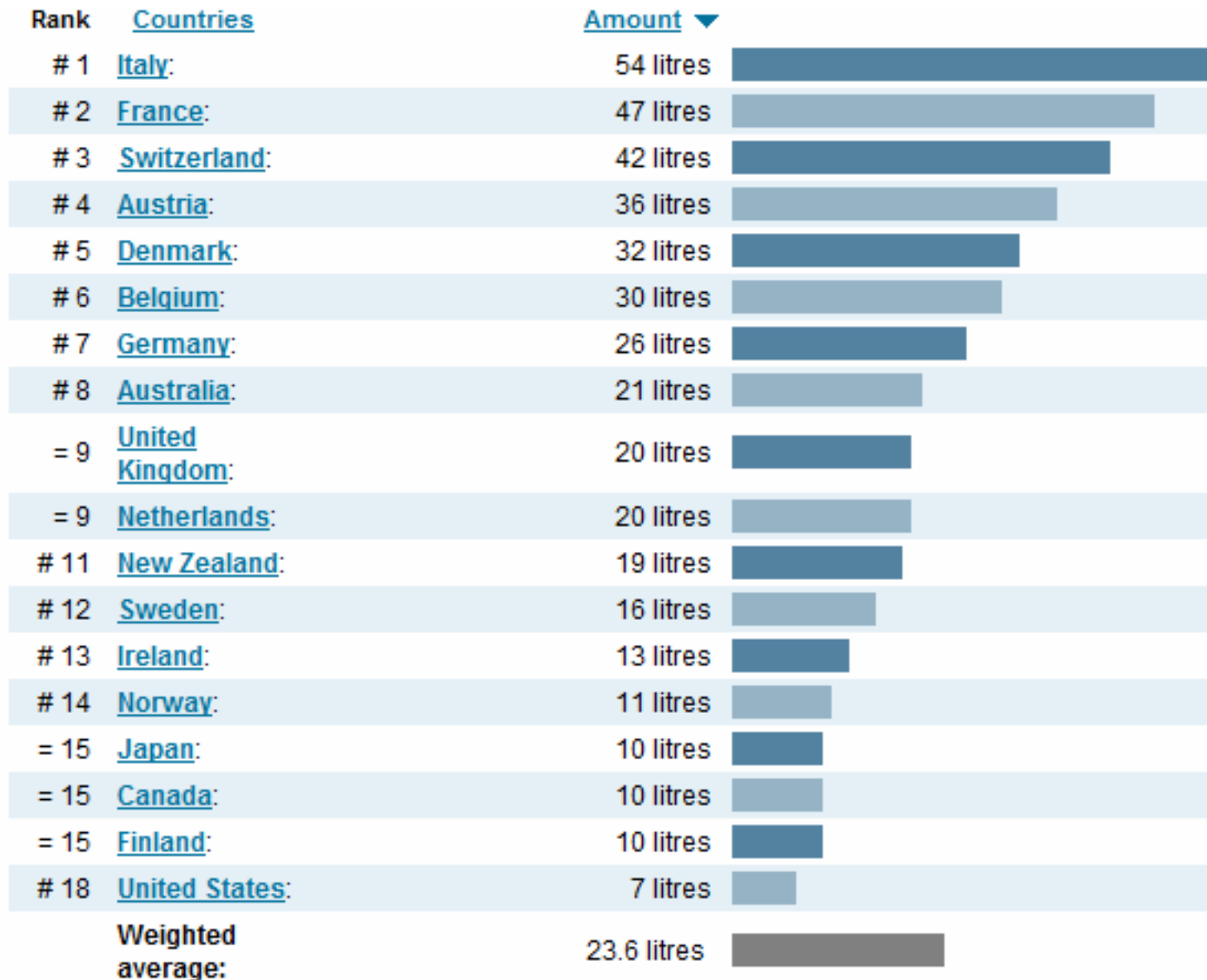
- Some problems are intact with cork closure viz.; cork taint, off flavours development (TCA and TBA) leakage and high price
- Screw caps are gaining high acceptance
- New closures are also coming in market like ZORK
- Screw caps lines Saran, Saranex Sarantin fill are working well

Packaging

- **PET packaging has some advantages like non-breakable, recyclable, light in weight etc.**
- **Disadvantages are also such as permeability to O₂ and CO₂, acetaldehyde migrates etc.**
- **PET is available as multilayer, coating to minimizing O₂ transport rate**
- **496 g glass is required for making one 750 ml wine bottle while only 54g PET is required for same bottle**
- **Diamond Clear (O₂ scavenger) is also available**
- **Tetrapack is well known to remove flavour compounds.**
- **Box in Bag is also popular in some countries.**

Marketing: Issues and strategies

Consumption of wines... Global recent trend (per annum/person)



Why people take wines

- Socially acceptable – In western countries socially acceptable. Food beverage in Maharashtra
- Health benefits - The health benefits of wine consumed in moderation relative to other forms of alcohol have become clearer in the past 5 years.
- People want “experiences” - Drinking wine is a sensory experience, like food, and wine offers a wide range of experiences based on different choices in grape types, regions, and wine-making styles.
- Affordability - Despite higher prices for collectible wine, wine is broadly affordable relative to other types of “experiences.”
- Quality is up
- Greater purchasing access - Access to a diverse selection of wine at competitive prices has been facilitated by the Internet and direct shipping.
- Enjoyment factor – creating an “enjoyment factor.” In general, wine has become part of many people's lifestyle.
- Celebrity “endorsements” - The “celebrity factor” has helped popularize wine, whether the celebrity is a winemaker (akin to celebrity chefs) or TV/movie celebrities profiled in Wine Spectator or other publications.
- Consumption is growing rapidly - Per capita wine consumption is on the rise

Health benefits of wines

- It is believed red wine is more beneficial than white
- Phenols and tannins has nutraceutical impact on human health
- Due to presence of *RESVERATROL* it is beneficial in cardio problems
- Benefits have been recorded in sugar problems
- Good for eye sight

Recommendation:
Always take in limit

www.balance-wines.co.za



KNOW YOUR LIMITS



2.5
UK
UNITS

per
187 ml
bottle



1.7
UK UNITS

per
125ml
glass

UK Chief Medical Officers recommend
adults do not regularly exceed:

Men	3-4 units daily
Women	2-3 units daily

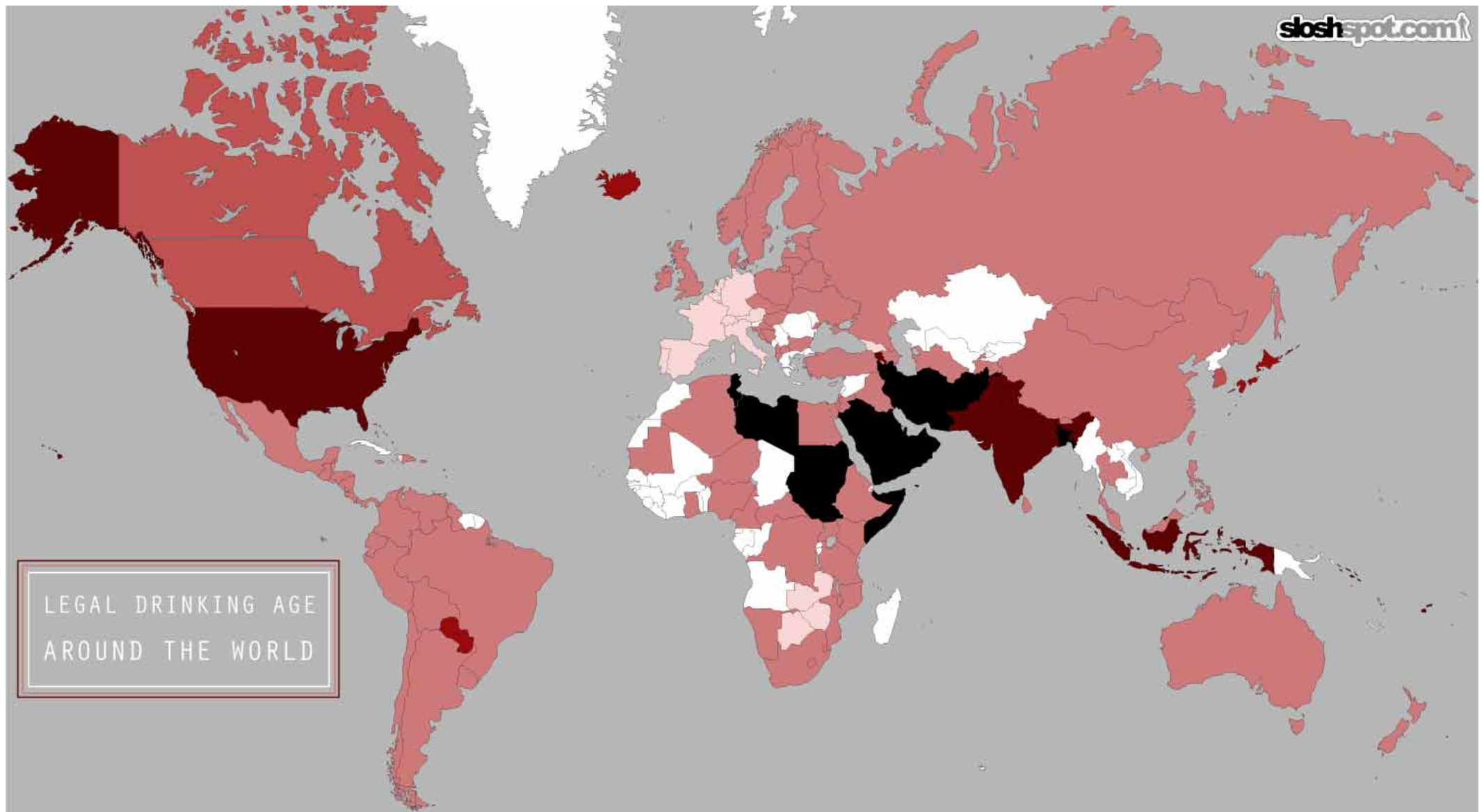
Avoid alcohol if pregnant or trying to conceive

www.drinkaware.co.uk

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003747 003444 >

LEGAL DRINKING AGE
AROUND THE WORLD



Various bottle sizes used for wine worldwide



Wine Standards... BIS and OIV

Sr. No.	Characteristic	BIS			OIV		
		Dry White/Red	Sweet White/Red	Sparkling Wine	Dry White/Red	Sweet White/Red	Sparkling Wine
1	Ethyl Alcohol(% by volume)	8- 15.5 (±5)	8- 15.5 (±5)	8 -15.5 (±5)	8.5-14.9%	8.5-14.9%	8.5-14.9%
2	Free from unpleasant aroma, unpleasant test, cloudiness, sediments or suspended matters, mould and bacterial growth						
3	Free from Ingredient injurious to health						
4	Color and Additives (except color) defined by PFA/CODEX/JECFA						
5	Taste and Aroma: permitted under PFA/FEMA/GRAS may be used						
6	Reducing residual sugar, g/l	10 Max	10-150	100, Max			
7	pH	3.0-4.0	3.0-4.0	3.0-4.0			
8	Total Acids (as tartaric acid), g/l, Max	10.00	10.00	10.00			
9	Volatile Acidity expressed as acetic acid, g/l, Max	1.0	1.0	1.0	20meq/L (1.2g/L)	20meq/L (1.2g/L)	20meq/L (1.2g/L)
10	Esters as ethyl acetate (expressed in terms of grams per litre of absolute alcohol) , Max	4.0	4.0	4.0			
11	Higher Alcohol as amyl alcohol (expressed in terms of g/l of absolute alcohol), Max	4.0	4.0	4.0			
12	Aldehydes as acetaldehyde (expressed	1.0	1.0	1.0			

	in terms of g/l of absolute alcohol), Max						
13	Total sulphur dioxide, mg/l, Max	250	250	250	200/ 150/ 200	300-400	
14	Free sulphur dioxide, mg/l, Max	100	100	100			
15	Copper (as Cu), mg/l, Max	5	5	5	1	1	1
16	Iron (as Fe), mg/l, Max	15	15	15			
17	Extracts, g/l, Max	50	50	50			
18	Tannins, g/l, Max	3	3	3			
19	Methyl alcohol (expressed in terms of g/l of absolute alcohol), Max	2.0	2.0	2.0	250/ 400/ 250 (mg/L)	250/ 400/ 250 (mg/L)	
20	Citric acid g/L				1	1	1
21	Arsenic mg/L				0.2	0.2	0.2
22	Boron mg/L(as Boric acid)				80	80	80
23	Bromine mg/L				1	1	1
24	Cadmium mg/L				0.01	0.01	0.01
25	Diethylene glycol mg/L				≤10	≤10	≤10
26	Malvidol diglucoside mg/L				15	15	15
27	Ethylene Glycol/Ethanediol				≤10	≤10	≤10
28	Fluoride mg/L				1-3	1-3	1-3
29	Ochratoxin A ug/L				2	2	2
30	Lead mg/L				0.15	0.15	0.15
31	Propane -1-2-diol/propylene glycol mg/L				150	150	300
32	Excess Sodium mg/L				60	60	60
33	Sulfate (express as potaasium sukfate) gm/L				1-2.5		
34	Zinc (mgL)				5	5	5

European Wine Quality Standard

	Special High Quality Wine	High Quality Wine (Cabinet)	Quality Wine	Country Wine (Vin Ordinaire)	Table Wine (blend, cuvee)
1	Alcohol (%)	> 12,8%	>11.1%	> 9.5%	> 8.7%
2	Alcohol g/L	> 215g/l	> 88g/l	> 85g/l	> 70g/l
3	Sugar g/L	> 102g/l	> 188g/l	> 181g/l	> 150g/l
4	Baume	> 12,4°	>11.1°	> 10.7°	> 9.1°
5	Brix	> 22,3°	>20.0°	> 19.4°	> 16.3°
6	Specific Density	> 1.094	>1.083	> 1.08	> 1.067
		(less than)	(less than)	(less than)	(less than)
7	Free Sulphur dioxide	< 70mg/l	<55mg/l	< 60mg/l	< 50mg/l
8	Total Sulphur dioxide	< 350mg/l	<260mg/l	< 300mg/l	< 210mg/l
9	Content of Natural Acid	7g/l	7g/l	7g/l	7g/l
10	All grapes Originating from Same region and Same Kind	All grapes Originating from Same region and Same Kind	All grapes Originating from Same region and Same Kind	All grapes Originating from Same region and Same Kind	All grapes Originating from Same region and Same Kind

SWOT analysis of Indian Wine Industries

<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none">• Indian wine consumption has grown 25-30% annually over a 5 year period.• Good climate for grape growing• Urban population is increasing.• Youth are craving an alternative to hard liquors and developing a more refined taste.• Wine is becoming more acceptable to women and youth.	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none">• Wine remains an elite taste.• Wine is difficult to store in India due to lack of cellars and refrigeration.• Less than 50 percent of the population is legally old enough to drink (25 yrs. old).• 400 million persons are 18 years old or younger.• Poor awareness of wine and infrastructure.
<p style="text-align: center;">Opportunities</p> <ul style="list-style-type: none">• 100 million persons will be legally allowed to drink alcohol (25 yrs. old) in the next 5 years.• Supermarkets are emerging to support wine distribution infrastructure.• Domestic market with increasing disposable income.• Growing tourism industry.	<p style="text-align: center;">Threats</p> <ul style="list-style-type: none">• The Indian constitution discourages alcohol consumption.• Wine viewed as a “sin” by some.• Indians still prefer whisky.• Advertising for alcoholic beverages is banned.• Domestic wine production is coddled by state governments.

Indian Wine consumption - historical and projected

(By volume)

<u>YEAR</u>	<u>TOTAL</u>	<u>DOMESTIC</u>	<u>IMPORTED</u>
<i>(Number of 9 Liter cases)</i>			
2004	550,000	470,000	80,000
2005	620,000	520,000	100,000
2006	750,000	630,000	120,000
2007	900,000	750,000	150,000
2008	1,100,000	920,000	180,000
2009	1,400,000	1,180,000	220,000
2010	1,700,000	1,440,000	260,000
2011	2,000,000	1,700,000	300,000
2015	4,000,000	3,400,000	600,000

Indian scenario

Wine consumption for 2008 by wine type (still wines)

	Table Wines (9L cases)		
Color	Domestic	Imports	Total
Red	480,000	120,000	600,000
White	420,000	50,000	470,000
Rose	20,000	10,000	30,000
Total	920,000	180,000	1,100,000

Wine Packaging



Urgent need to design....

There are some sectors of the packaging industry where wine packaging need to improve. There is wastage of wine due to reaction against the climatic conditions.

Te Points are :-

- * When wine bottle is kept straight there is no contact between the cork and the bottle.
- * As cork is made of a porous material due to loss in contact with wine and atmospheric heat the cork shrinks.
- * Because of shrinking of cork the air comes inside the bottle.
- * Oxygen present in the air reacts with wine to result in fermentation of wine.
- * In fermentation Co_2 is released.
- * As atomic size of Co_2 particle is higher the bottle burst open.



Comparative data of MRLs (mg/L) for wines provided by different countries

	Al	Sb	As	B	Cd	Ca	Co	Cu	Fe	Pb	Hg	Se	Ag	Na	Ti	Zn
Australia		0.15	0.1		0.05			5		0.2	0.03	0.2			50	5
Argentina					0.01	0.25		1		0.2				230		
Canada		0.02	0.1		0.5		0.02	1	15-20	0.2	0.1		0.5	500		5
EU								1								
Germany	8		0.1	80	0.01			2		0.25					1	5
Hongkong			0.14							1	0.5				230	
New Zealand		0.15	0.2					2		0.2					40	5
Norway								1	10							
Poland			0.2		0.03			4		0.3	0.01				20	10
Russia			0.2		0.03			5	20	0.3	0.005					
South Africa			0.2	80	0.01			1	10	0.2	0.05	1		100	100	5
Switzerland			0.2	80	0.01			1		0.1				60		5
Turkey			0.2					20		0.6						10
USA								0.5		0.3						

50 Wine Sample in Region (mg/L)			
Element	Nasik	Sangli	Pune
23Na	39-93	10-126	53-180
24Mg	80-400	0.5-190	117-190
27Al	3.5-7	0.2-5.2	3.8-7.2
29Si	55-88	16-170	66-92
39K	653-194	413-193	981-227
44Ca	10-207	1-138	13-139
51V	0.02-0.11	0.002-1.5	0.016-0.119
52Cr	0.089-0.229	0.001-1.5	0.088-0.331
54Fe	3.248-6.267	0.143-4.50	4.2-6.9
55Mn	0.815-3.773	0.008-2.911	0.916-2.509
58Ni	0.052-0.137	0.001-1.476	0.101-0.280
59Co	0.003-0.008	0-0.019	0-0.017
63Cu	0.061-0.420	0.008-0.415	0.042-0.226
66Zn	0.340-1.02	0.014-1.723	0.321-0.652
75As	0-0.01	0-0.180	0-0.005
107Ag	0-0.171	0-0.172	0-0.03
136Ba	0.06-0.23	0-1.8	0.06-0.140
207Pb	0.018-0.074	0-0.09	0.031-0.012
110Cd	0-0.002	0-0.003	0-0.005

Status of heavy metals in Indian wines

50 samples on Indian wines were analyzed at NRCG. All samples comply BIS and other international standards. Heavy metal content in Indian wines does not represent a possible toxicological problem for human health.

Thanks...



...for your attention!