HOW WILL CLIMATE CHANGE AFFECT VINE NUTRIOTIONAL STATUS IN DIFFERENT SOILS?

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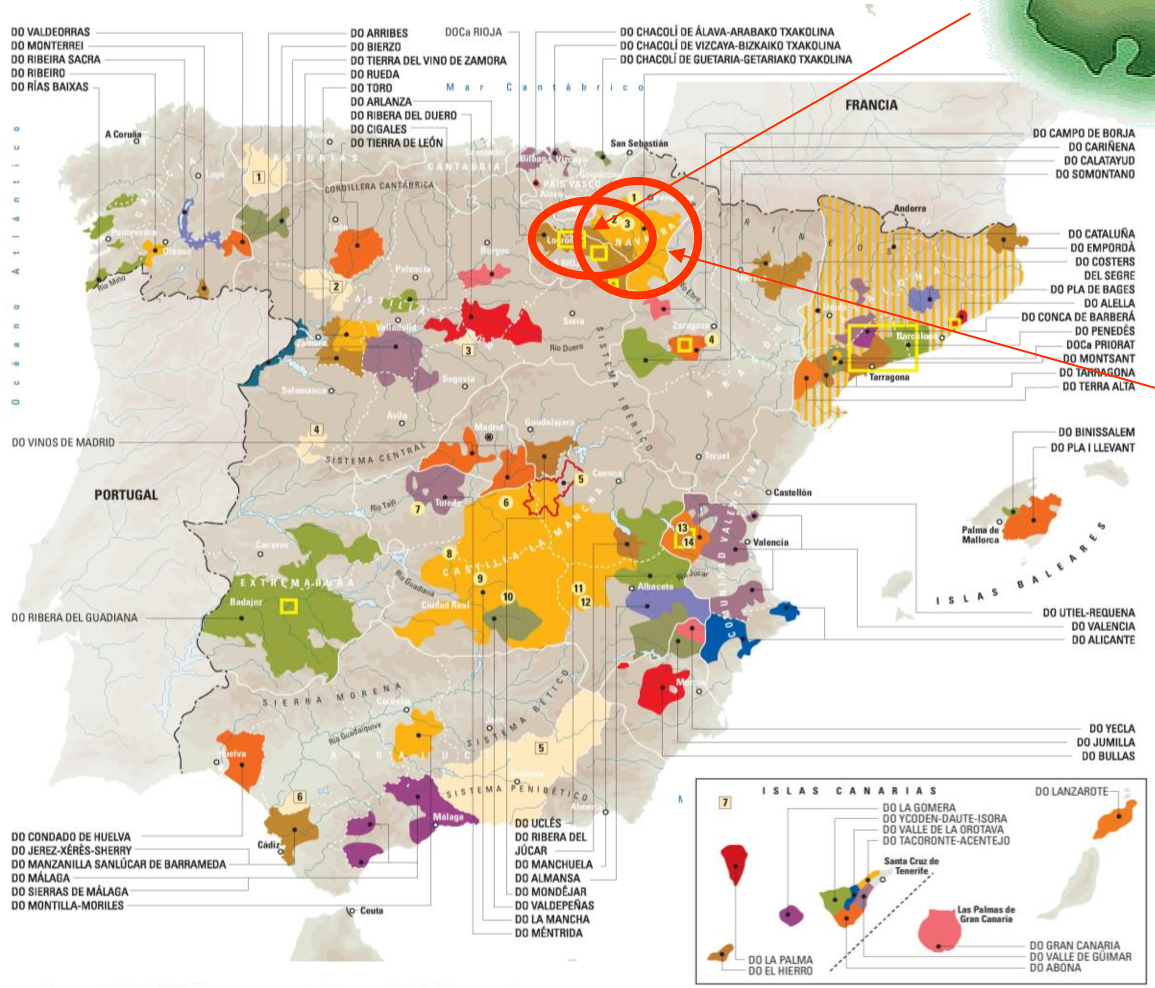
INTRODUCTION

Wine Designation of Origin in Spain



D.O.Ca Rioja

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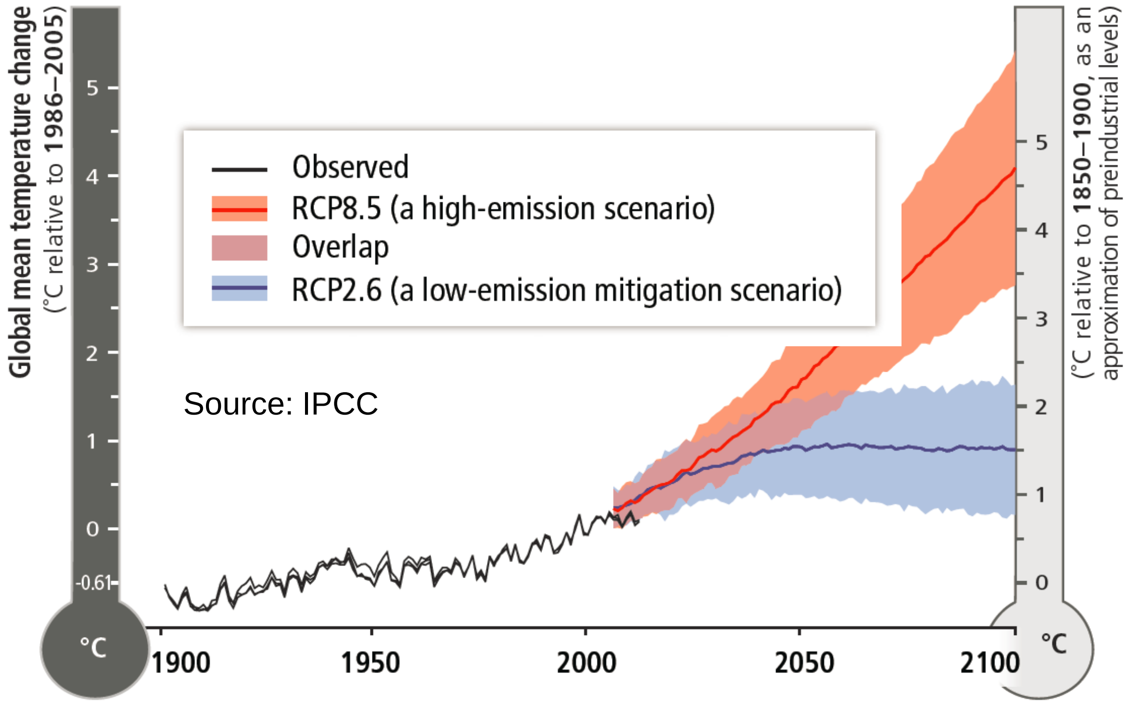
INTRODUCTION

- Climate change
  - CO_2
  - Temperature
  - Relative humidi
  - Water availabili
- Soil



Nutrition is a releva
because it influences grapevine growth, berry composition, as well as must and wine quality

OBJECTIVE

- **The aim of this work was to evaluate the effect of…**
  - Climate change (increased CO_2, higher temperature and lower relative humidity)
  - Soil texture
  - Water stress
- **…on the nutritional status and must K concentration of grapevine (Vitis vinifera L.) cv. Tempranillo**

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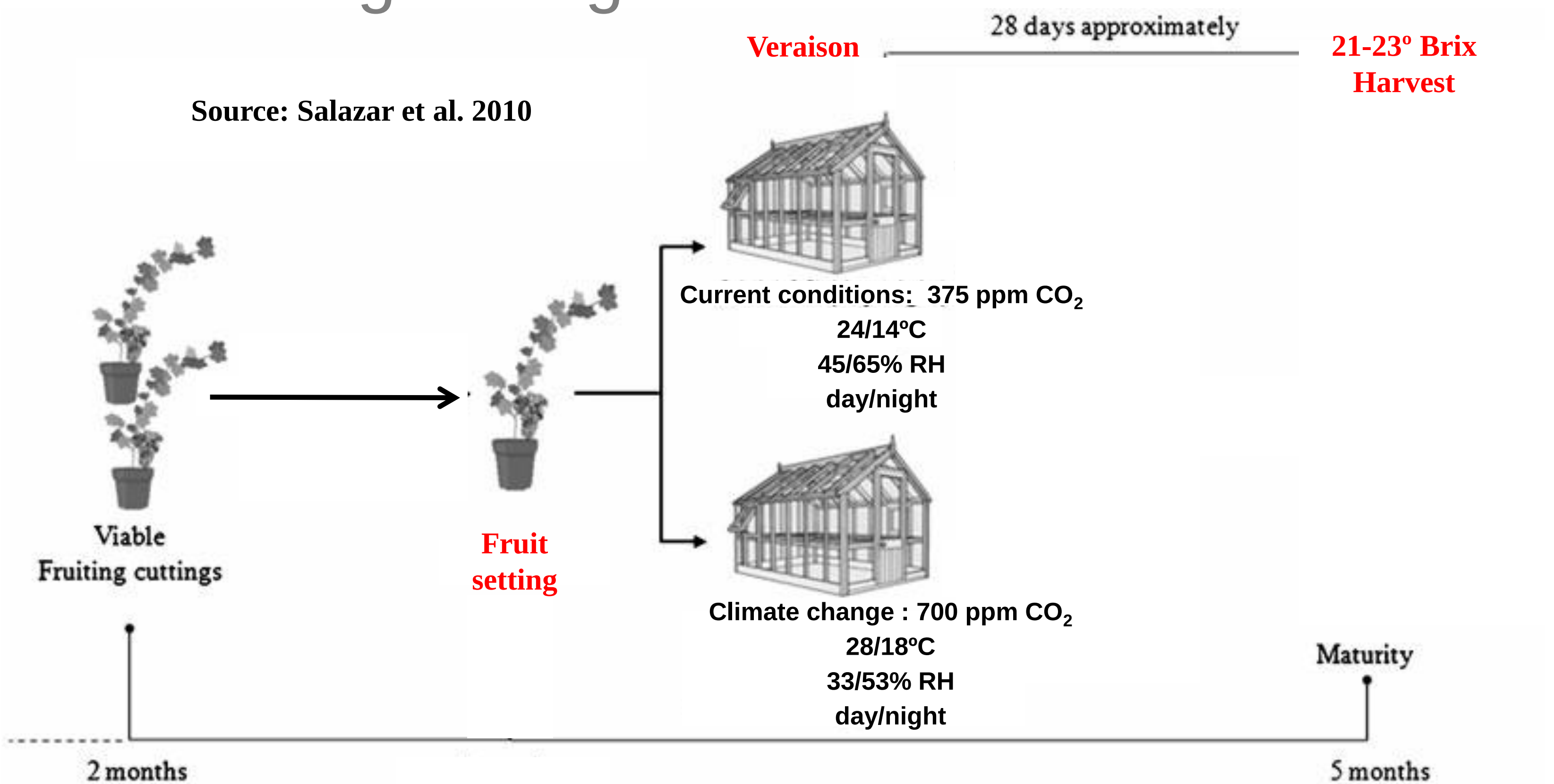
MATERIAL AND METHODS

- A greenhouse experiment → potted, own-rooted fruit-bearing cuttings.



MATERIAL AND METHODS

EXPERIMENTAL DESIGN

Greenhouse	Soil texture	Water stress
Climate change : **700 ppm CO_2** **28/18ºC** **33/53% RH** **day/night**	100% soil (40% clay)	Well irrigated
		Water deficit
	Mixed soil 50% soil + 50% sand	Well irrigated
		Water deficit
	Mixed soil (Sandy) 25% soil + 75% sand	Well irrigated
		Water deficit
Current conditions: **375 ppm CO_2** **24/14ºC** **45/65% RH** **day/night**	100% soil (40% clay)	Well irrigated
		Water deficit
	Mixed soil 50% soil + 50% sand	Well irrigated
		Water deficit
	Mixed soil (Sandy) 25% soil + 75% sand	Well irrigated
		Water deficit

-Typical Rioja clay Soil 100% → 40% clay content, pH 8,84

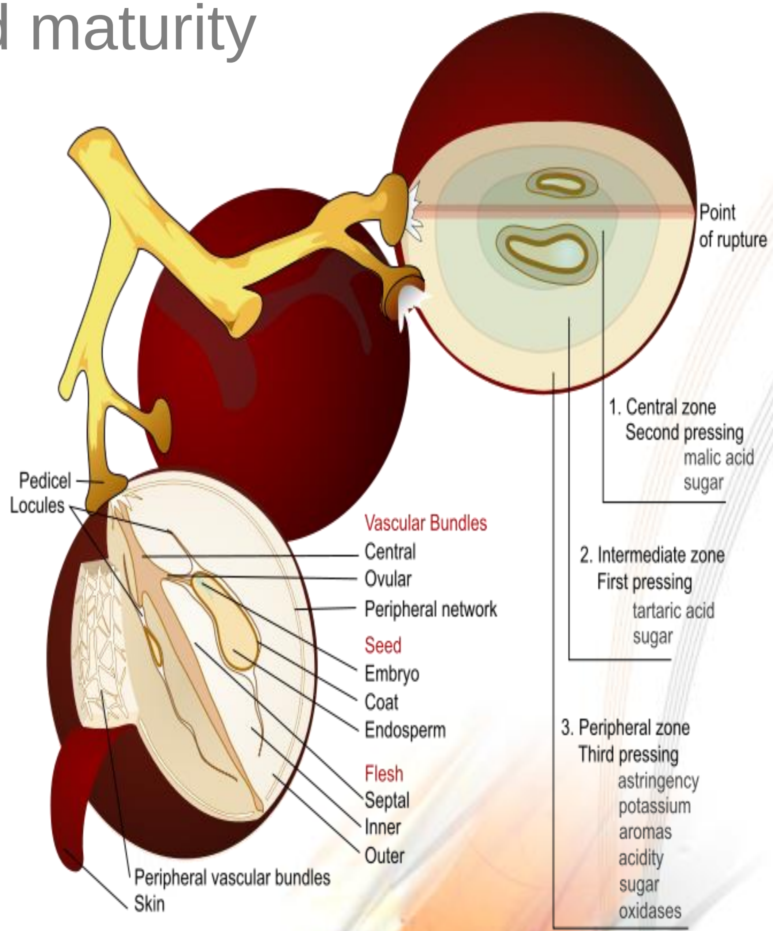
-Water stress

- Well-irrigated (WI): 20-35% of soil water content (Field Capacity)
- Water deficit (WD): approx. 10% of soil water content → 40% less than WI

-12 treatments x 9 plants/treatment = 108 plants

MATERIAL AND METHODS

- Leaf blade samples at veraison and maturity
  - N, K, Mg, Na, Ca, Mn, Fe, Zn …
- Qualitative parameters
  - Skin/Pulp ratio
  - Must K
  - Anthocyanins content
  - Polyphenol content
  - Colour intensity



MATERIAL AND METHODS

- **Statistical analysis**
  - 3-way ANOVA procedure
  - Completely randomized design
  - No interaction between factors

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RESULTS AND DISCUSSION

– On the whole, there was not any significant interaction among factors

- **CLIMATE CONDITIONS**
  – Lower nutrition concentration in leaf than those grown under current conditions

Veraison	N %	K %	Ca %	Mg %	Na mg kg^{-1}	Fe mg kg^{-1}	Mn mg kg^{-1}	Zn mg kg^{-1}
CO_2-T-RH regime								
Curr	2.77A ± 0.06	0.71 ± 0.04	2.41A ± 0.09	0.42 ± 0.02	107.8 ± 6.6	58.1 ± 2.1	123.4 ± 6.4	33.8 ± 2.6
CC	2.47B ± 0.07	0.70 ± 0.03	2.13B ± 0.09	0.39 ± 0.02	101.8 ± 6.5	52.1 ± 2.4	107.0 ± 6.4	27.6 ± 2.5
	**	ns	*	ns	ns	INT	INT	ns

Full maturity	N %	K %	Ca %	Mg %	Na mg kg^{-1}	Fe mg kg^{-1}	Mn mg kg^{-1}	Zn mg kg^{-1}
CO_2-T-RH regime								
Curr	2.60A ± 0.07	0.73 ± 0.04	2.44 ± 0.09	0.38 ± 0.03	83.4 ± 4.2	62.6 ± 3.0	110.3 ± 6.2	47.3A ± 3.6
CC	2.25B ± 0.05	0.65 ± 0.03	2.55 ± 0.10	0.43 ± 0.03	83.5 ± 5.4	55.51± 2.2	103.7 ± 5.7	28.6B ± 1.7
	***	ns	ns	ns	ns	ns	ns	***

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RESULTS AND DISCUSSION

- **WATER DEFICIT**
  - Leaf blades from water-stressed plants had higher concentration of the nutrients compared with those well-watered.

Veraison	N %	K %	Ca %	Mg %	Na mg kg^{-1}	Fe mg kg^{-1}	Mn mg kg^{-1}	Zn mg kg^{-1}
Water availability (WA)								
WW	2.57 ± 0.06	0.72 ± 0.03	2.17 ± 0.10	0.39 ± 0.01	86.6b ± 4.9	51.6 ± 2.5	107.0 ± 7.1	28.8 ± 2.8
WD	2.70 ± 0.08	0.69 ± 0.03	2.38 ± 0.08	0.42 ± 0.03	126.6a ± 5.8	59.2 ± 1.7	124.8 ± 5.1	32.8 ± 2.1
	ns	ns	ns	ns	***	INT	INT	ns

Full maturity	N %	K %	Ca %	Mg %	Na mg kg^{-1}	Fe mg kg^{-1}	Mn mg kg^{-1}	Zn mg kg^{-1}
Water availability (WA)								
WW	2.40 ± 0.07	0.74a ± 0.03	2.42 ± 0.10	0.41 ± 0.03	77.2 ± 4.3	57.3 ± 2.7	93.2b ± 5.9	37.3 ± 3.3
WD	2.44 ± 0.07	0.63b ± 0.04	2.58 ± 0.09	0.41 ± 0.03	90.3 ± 5.2	60.6 ± 2.6	121.5a ± 4.8	37.9 ± 3.1
	ns	*	ns	ns	ns	ns	***	ns

- However, K concentration was higher at full maturity in the well-irrigated treatment.

RESULTS AND DISCUSSION

- **SOIL TEXTURE**
  - Soil texture in general did not affect plant nutrition, but…
  - Berries from plants grown under more clayey soil had a higher must K

	K (g kg^{-1})
Water availability (WA)	
WW	2.40 ± 0.04 a
WD	2.26 ± 0.03 b
Soil texture (ST)	
41% clay	2.42 ± 0.05 a
19% clay	2.33 ± 0.05 ab
8% clay	2.25 ± 0.03 b

CONCLUSION

- Climate change resulted in nutrients reduction.
- Future expected water deficit altered grape nutritional status.
- Soil texture influenced K concentration, where higher concentration was observed in more clayey soils.
- This must K concentration increase could be a problem in terms of wine acidity loss, especially since one of the adverse effects of climate change will also be a lower acidity.

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THANK YOU FOR YOUR ATTENTION

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