



26 NOV  
TO  
1 DEC 2023

SOMERSET WEST  
SOUTH AFRICA



# Study on Restricted Spring Growth Syndrome (RSG)

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# 12-Ene-2022

Normal Growth



Restricted Growth



# 12-Ene-2022

## Normal Growth



## Restricted Growth





# 17-Feb-2022

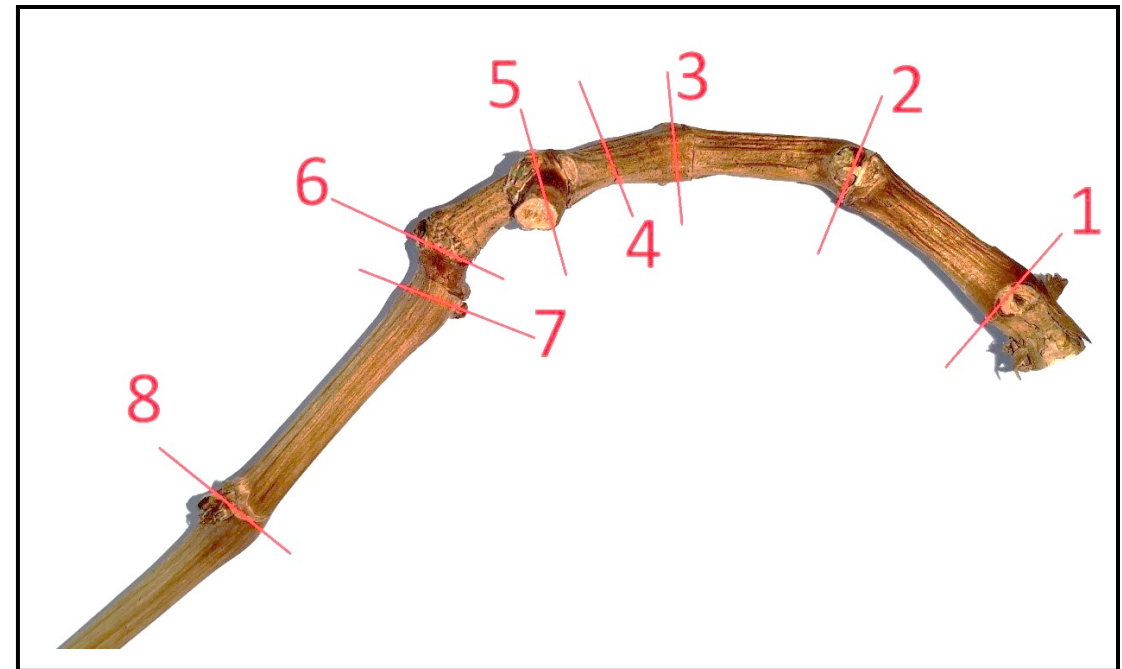
Normal Growth



Restricted Growth



# Poor shoot development





# Survey in 4 different vineyards of 'Sweet Globe' during 2022

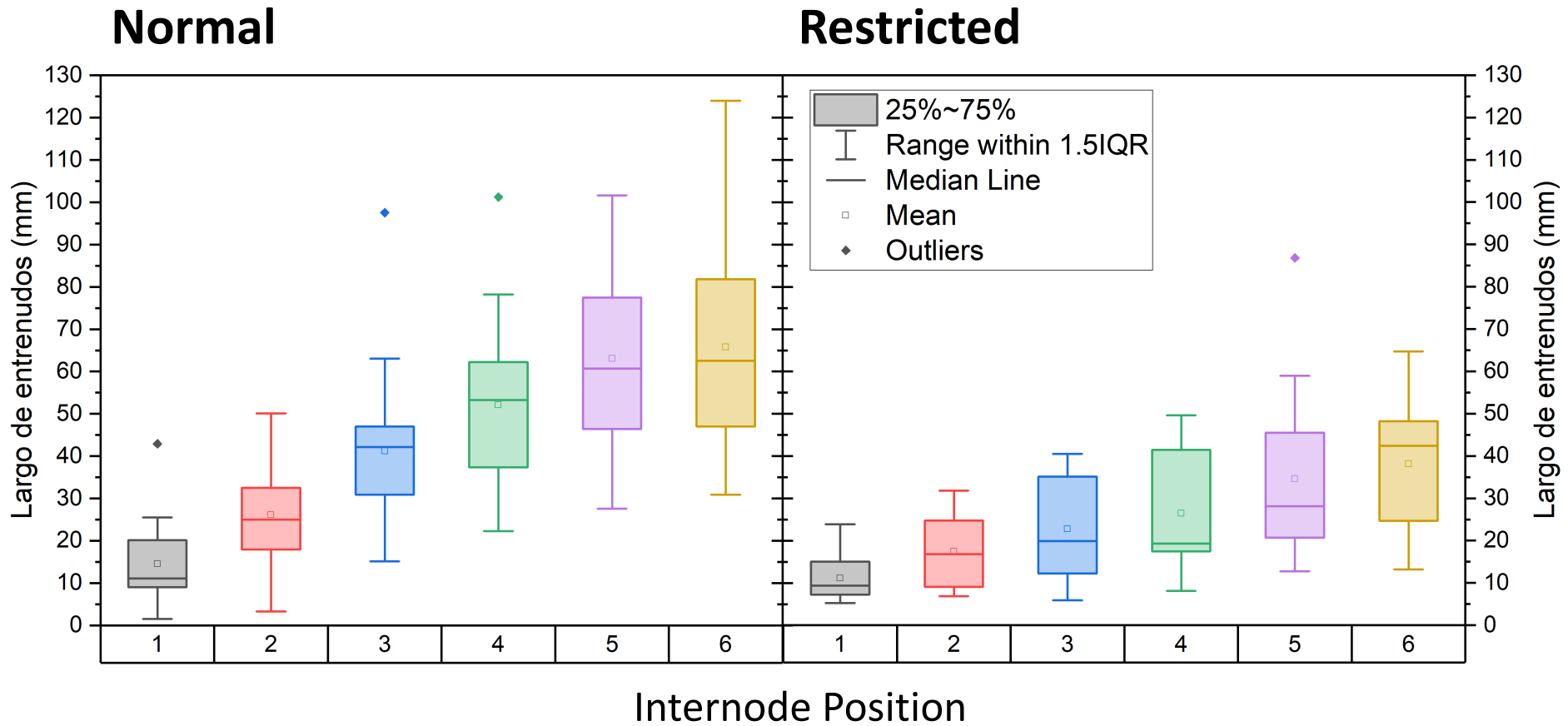
- San Vicente: **Control vineyard**, never affected by RGS, established in 2019 using Freedom rootstock, an Overhead trellis system, pruned to 6 buds.
- Los Andes: **Affected** by RGS, established in 2018 using Paulsen1103 rootstock, an Open Gable trellis system, pruned to 2-3 buds.
- Lampa: **Affected** by RGS, established in 2018 using Ramsey rootstock, an Overhead trellis system, irregular pruning.
- Rancagua: **Affected** by RGS, established in 2019 using Harmony rootstock, an Open Gable trellis system, pruned to 2-3 buds.

# Pathogen Screening

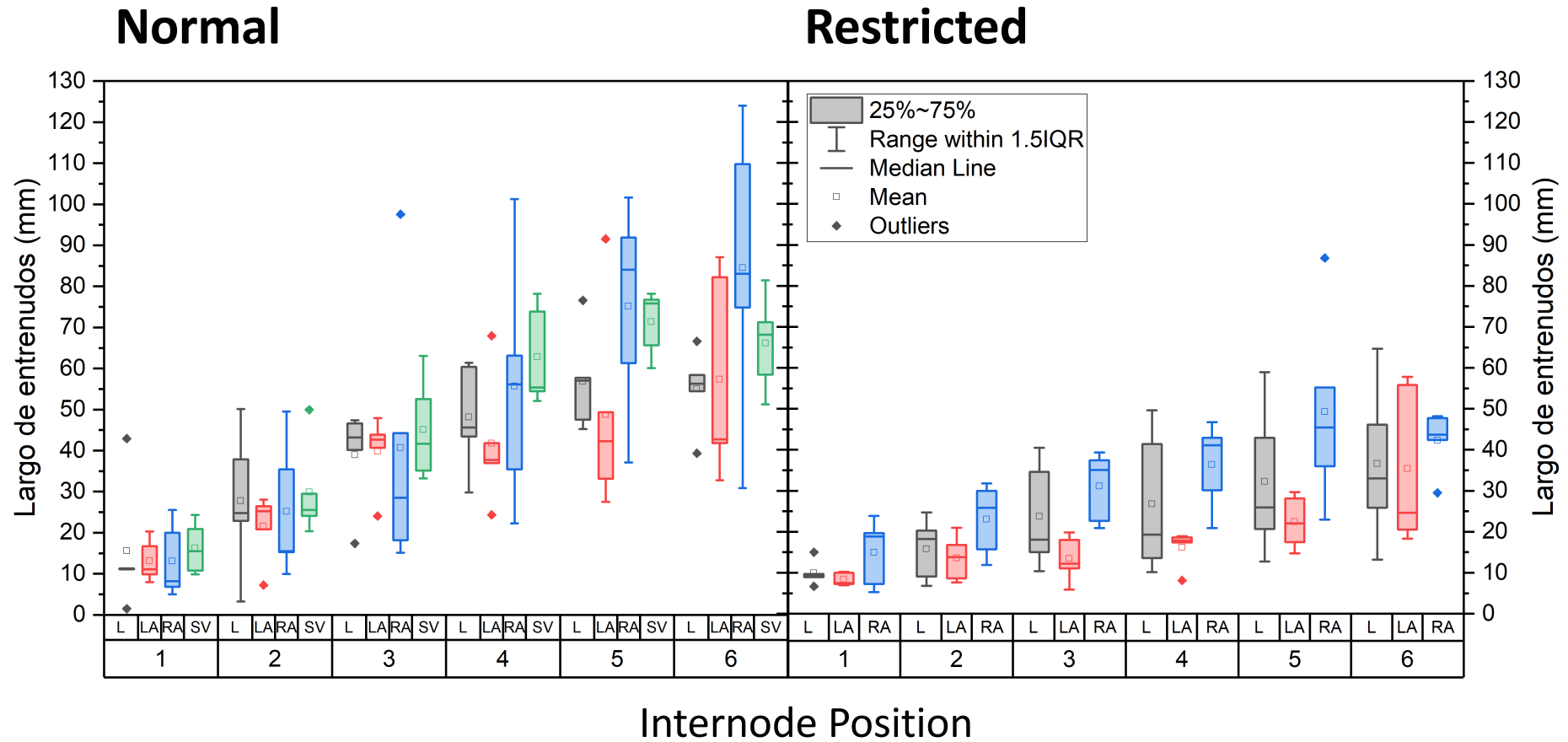
- No presence of vine trunk diseases or other pathogenic fungus
- No presence of pathogenic bacteria
- Virus

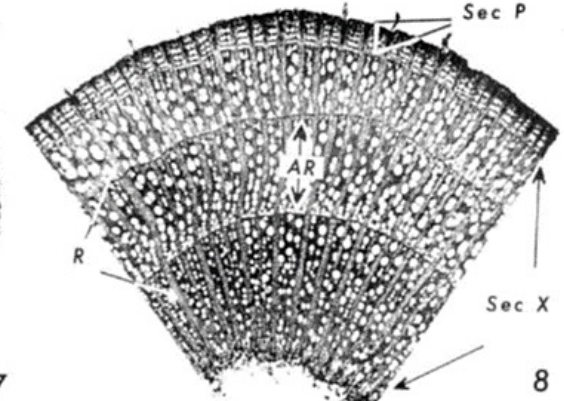
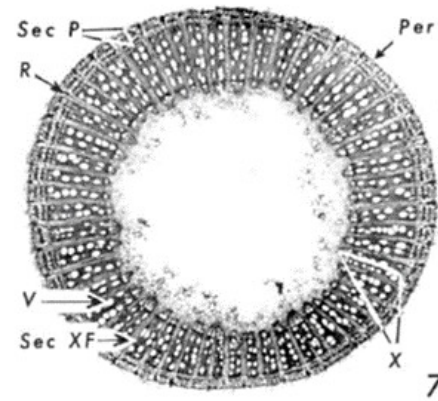
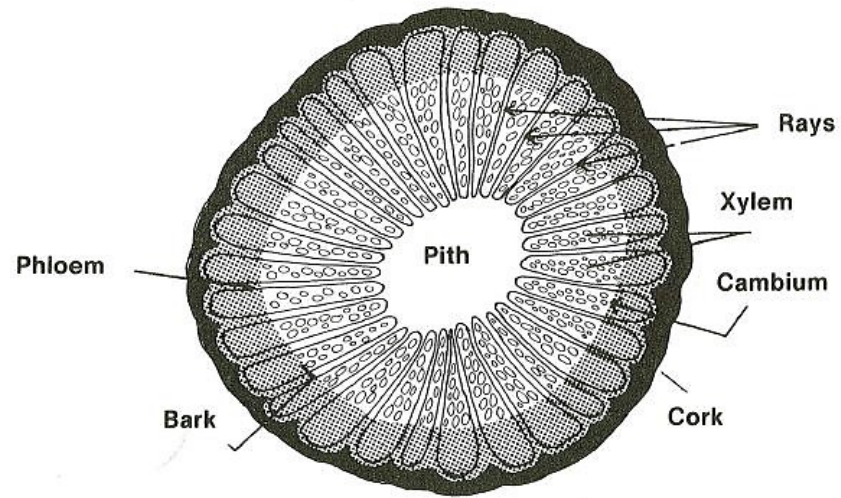
<i>Vineyard</i>	<i>Condition</i>	<i>Virus Presence</i>				
		<i>GLRaV-3</i>	<i>GFkV</i>	<i>GVA</i>	<i>GRSPV</i>	<i>GFLV</i>
<b>San Vicente</b>	<b>Normal</b>	(-)	(-)	(-)	(+)	(+)
<b>Los Andes</b>	<b>Normal</b>	(-)	(-)	(+)	(+)	(-)
	<b>Restricted</b>	(-)	(-)	(+)	(-)	(-)
<b>Rancagua</b>	<b>Normal</b>	(-)	(-)	(+)	(-)	(+)
	<b>Restricted</b>	(-)	(-)	(+)	(-)	(+)
<b>Lampa</b>	<b>Normal</b>	(-)	(-)	(-)	(+)	(+)
	<b>Restricted</b>	(-)	(-)	(-)	(+)	(+)

# Internode Length (mm)



# Internode Length (mm)



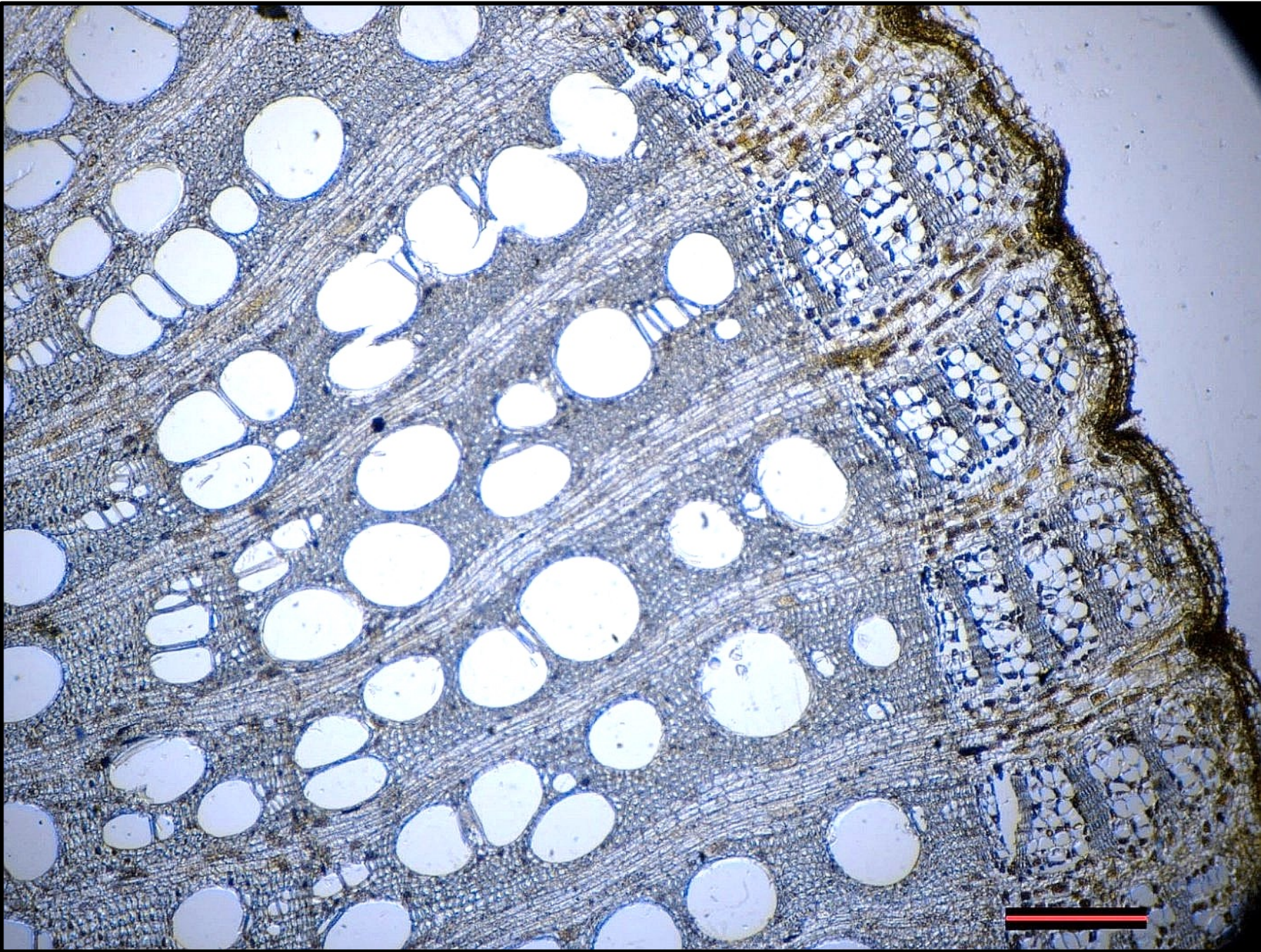


# Anatomy of two-year old wood

San Vicente, Los Andes, Lampa, Rancagua, 2022

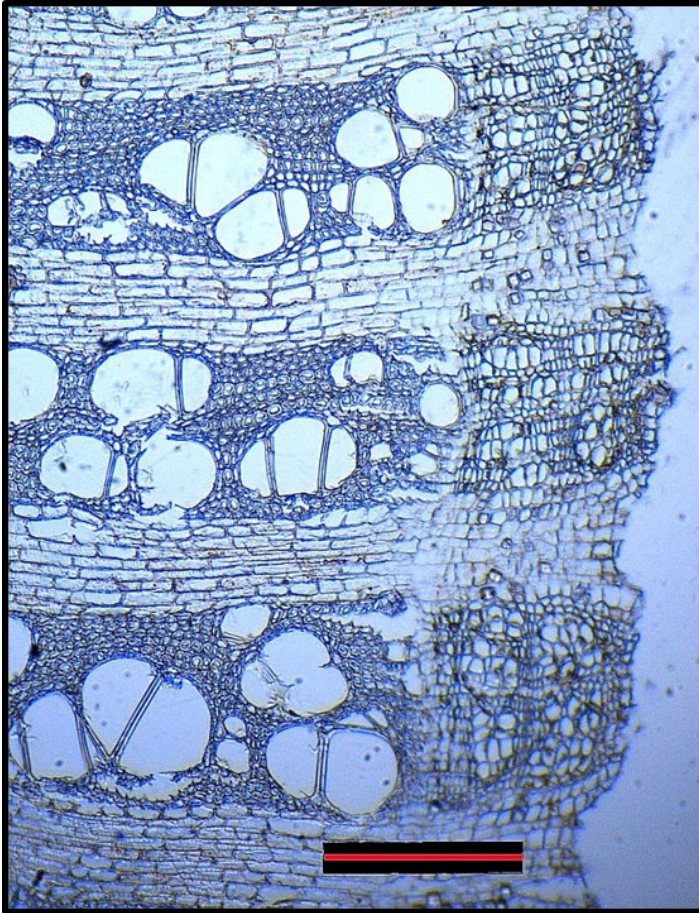
# San Vicente

Vineyard never affected by RSG

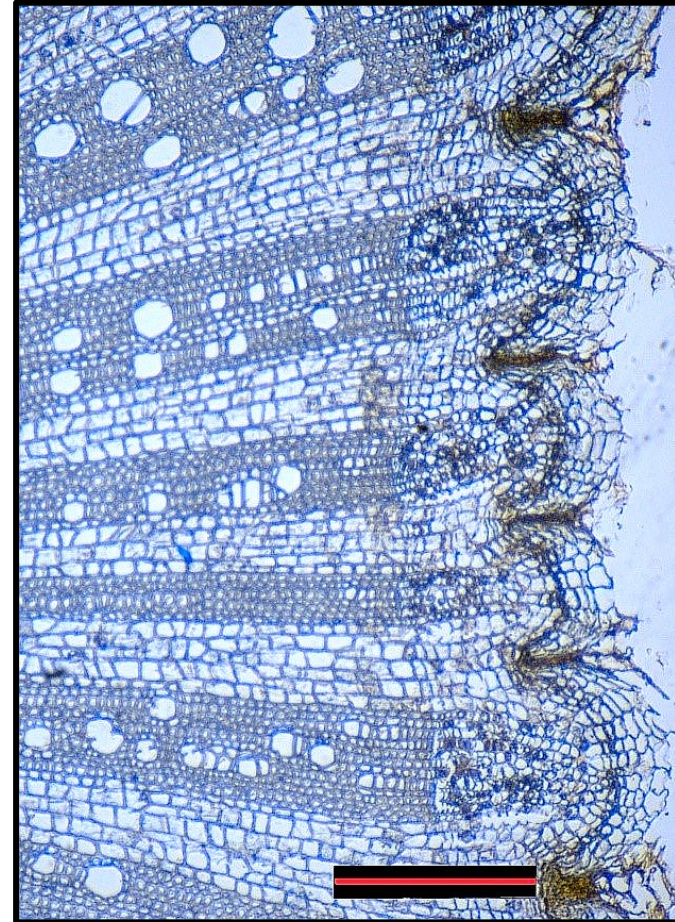


# Los Andes

Normal Growth

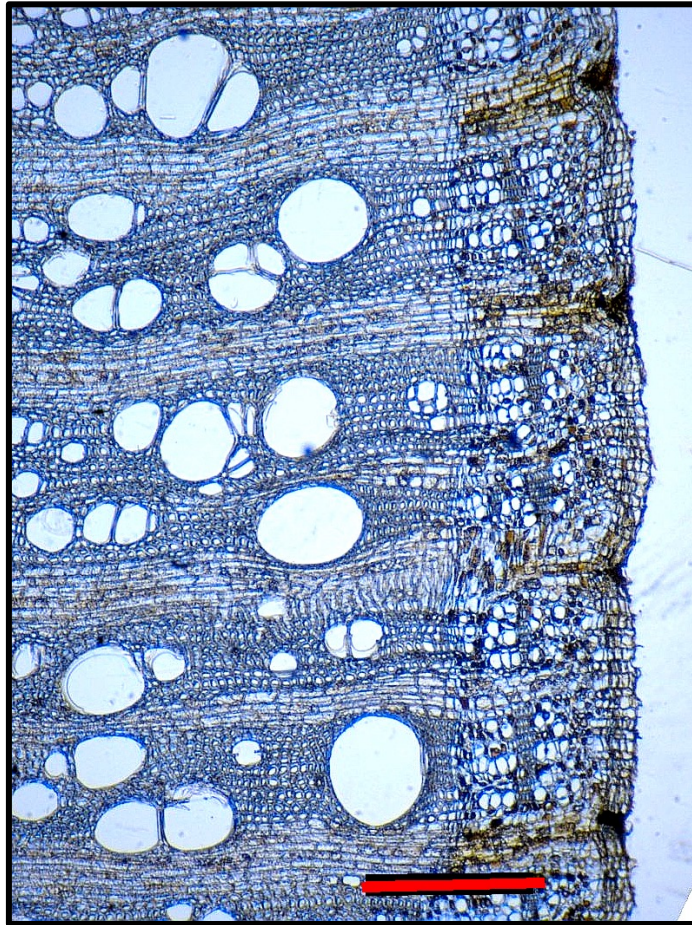


Restricted Growth

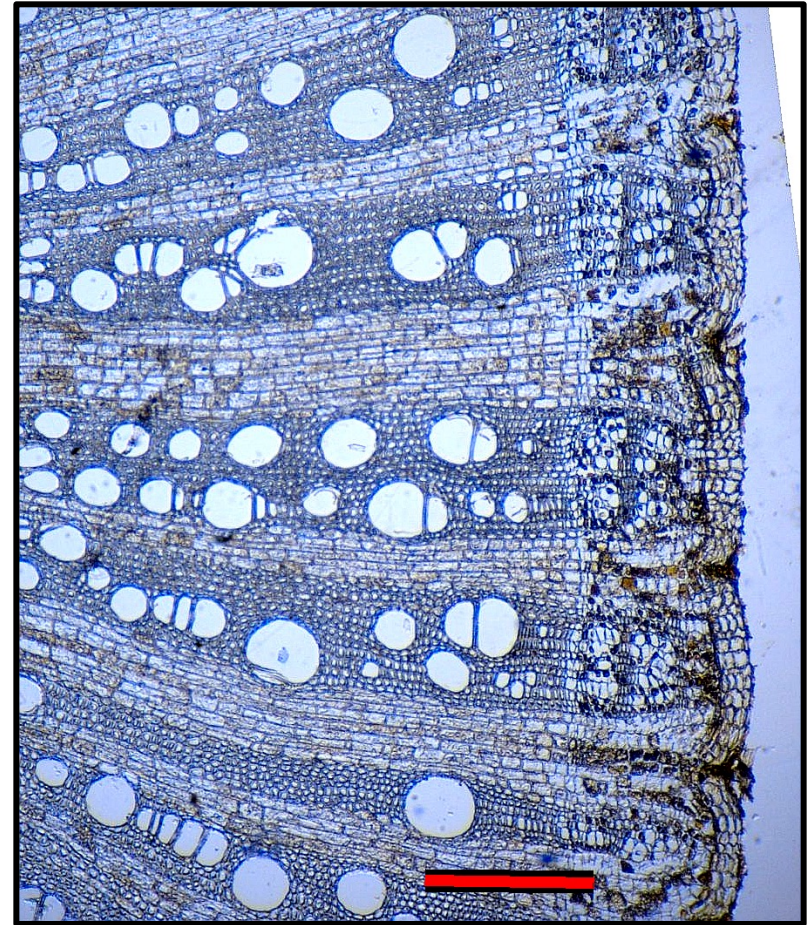


# Rancagua

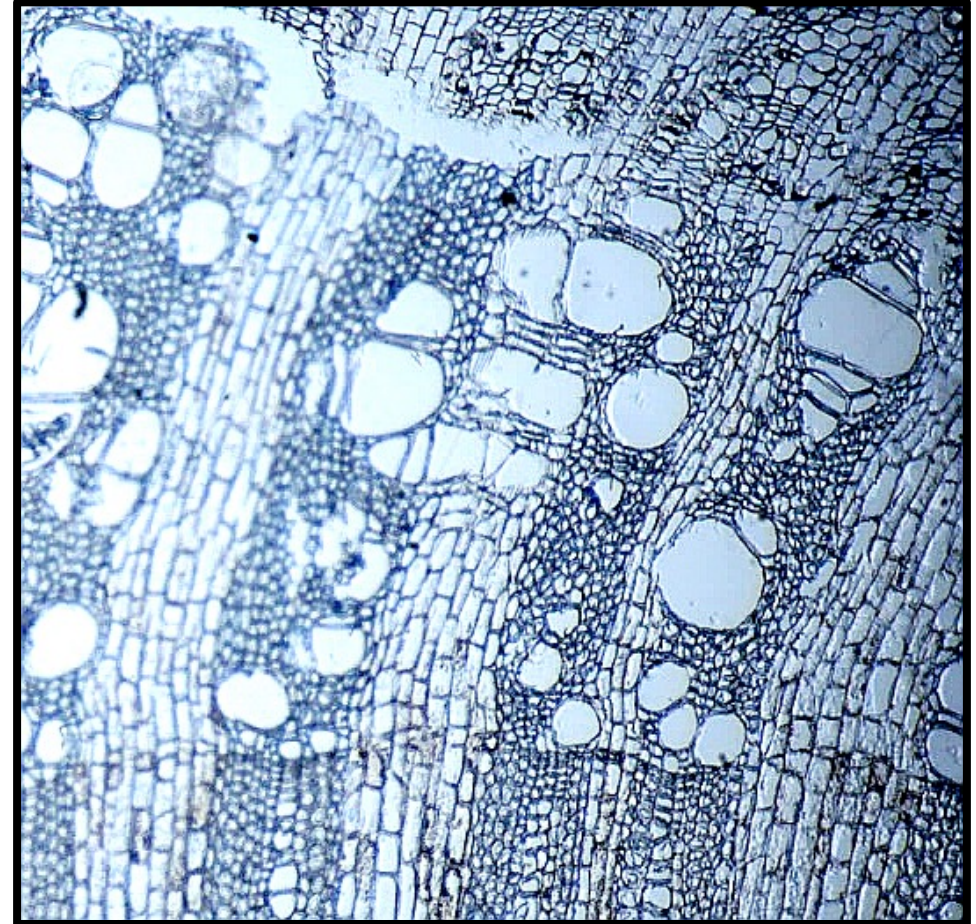
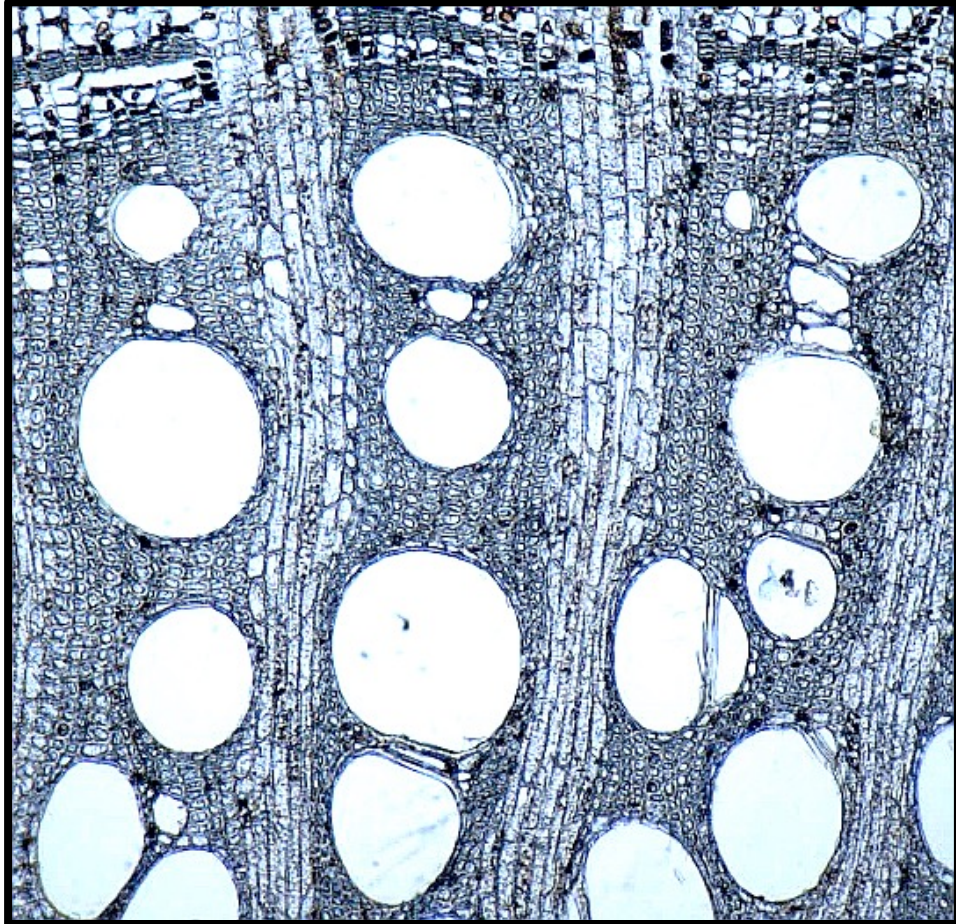
Normal Growth



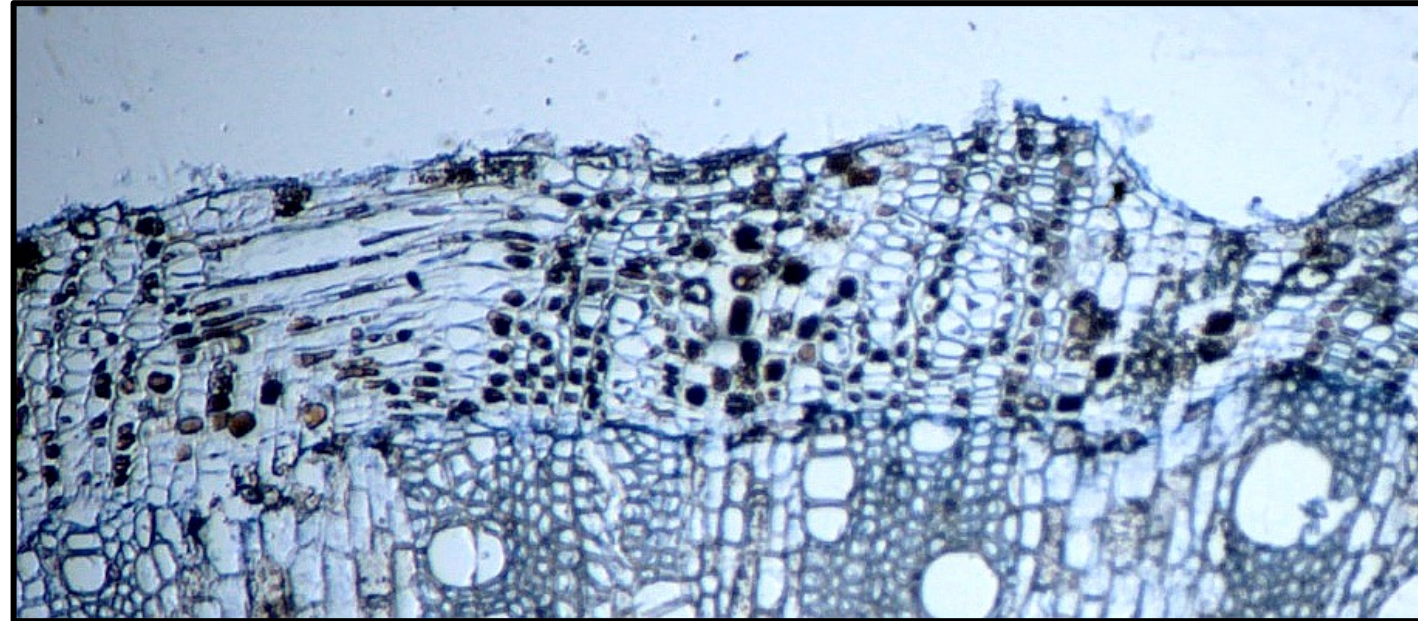
Restricted Growth



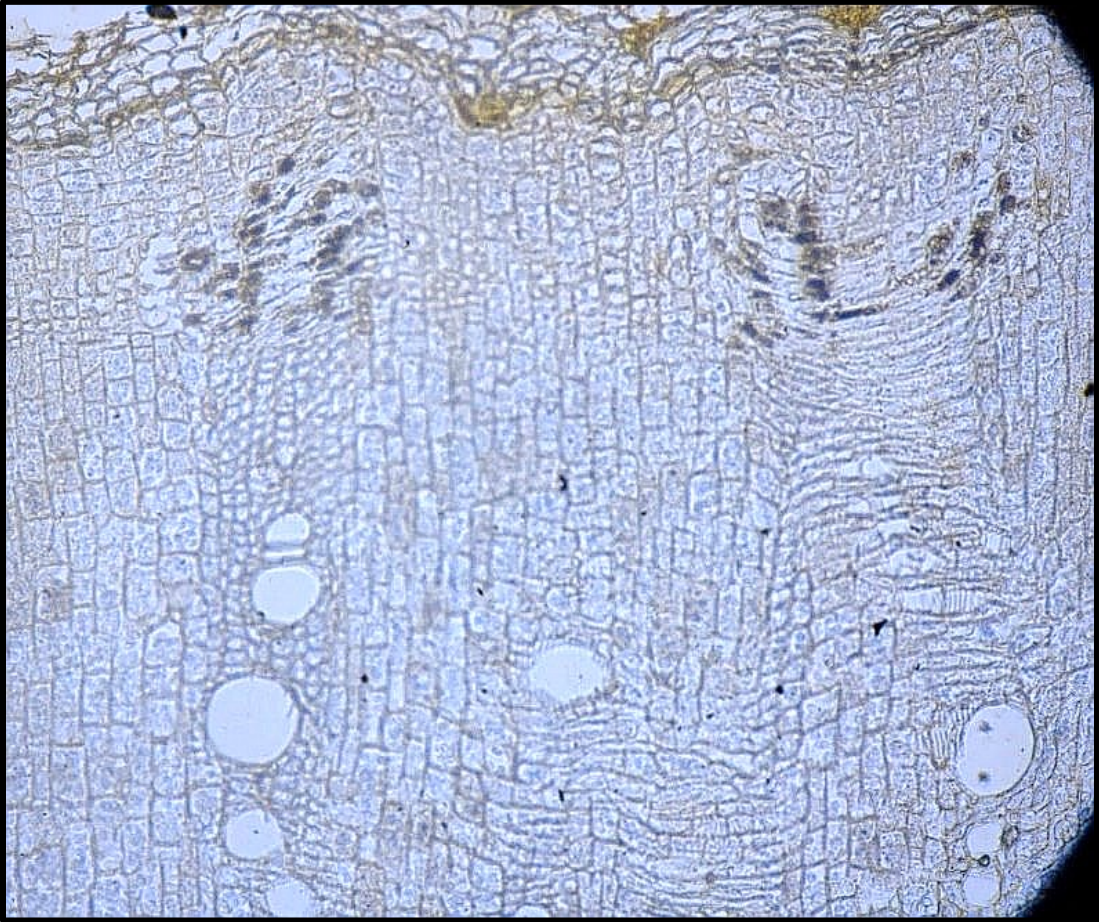
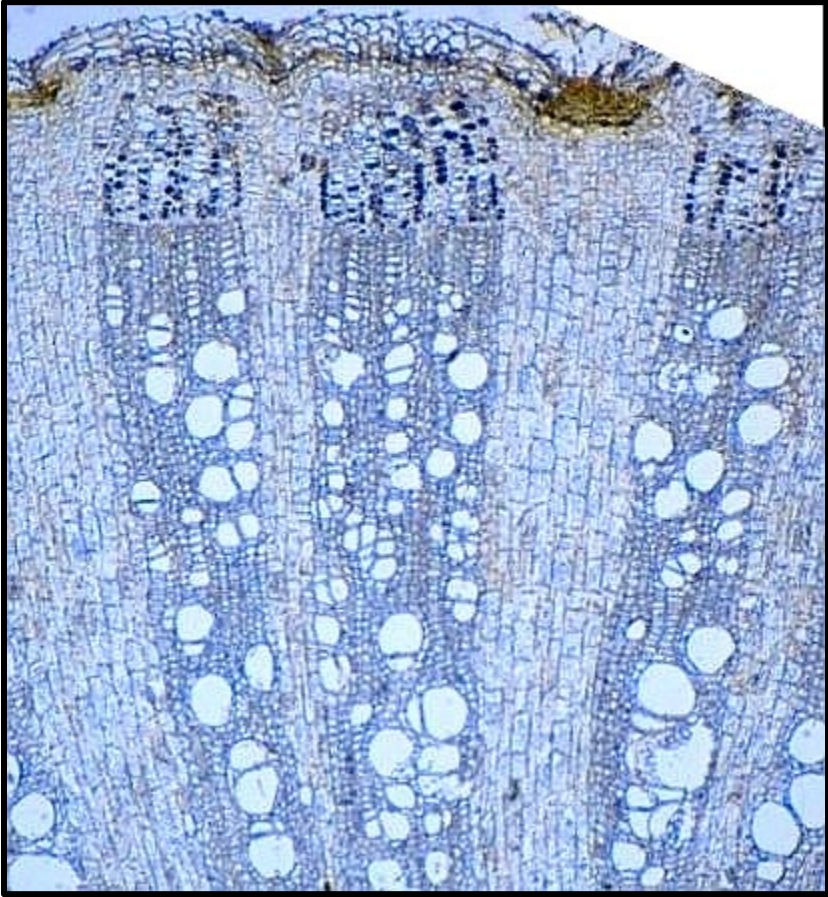
# Altered xylem anatomy



# Altered phloem anatomy



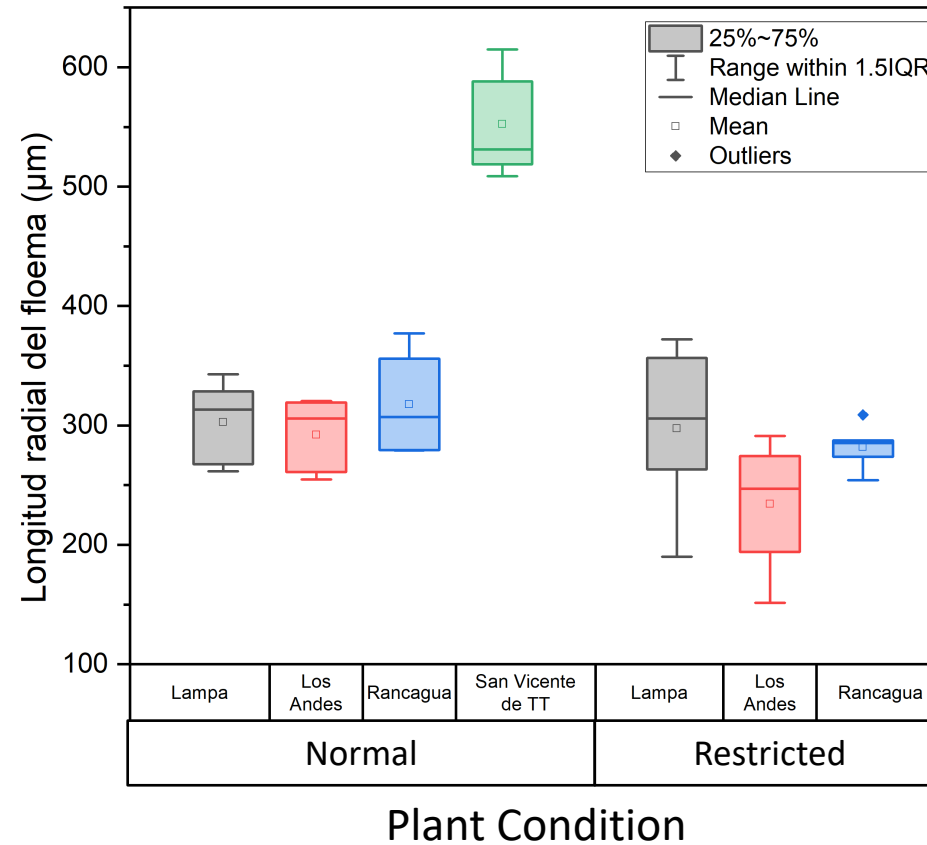
# Vascular disorganization



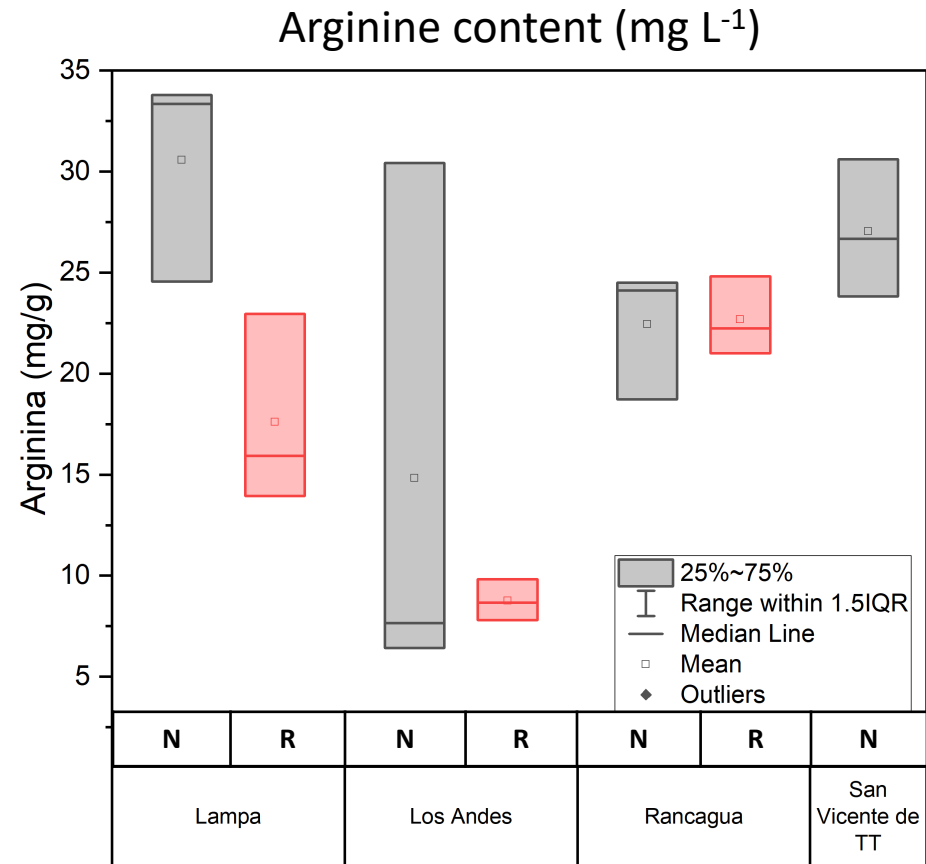
# Xylem and Phloem calculated metrics from all vineyards

	<i>Condition</i>	<i>Mean</i>	<i>Standard Error</i>	<i>P-value</i>
Vessel element perimeter ( $\mu\text{m}$ )	Normal	309.4	13.2	0.0001*
	Restricted	179.5	6.3	
Vessel element cross-section area ( $\mu\text{m}^2$ )	Normal	8785.3	703.9	0.0001*
	Restricted	3943.6	311.9	
Phloem radial length ( $\mu\text{m}$ )	Normal	368.7	27.3	0.0700
	Restricted	273.8	15.5	

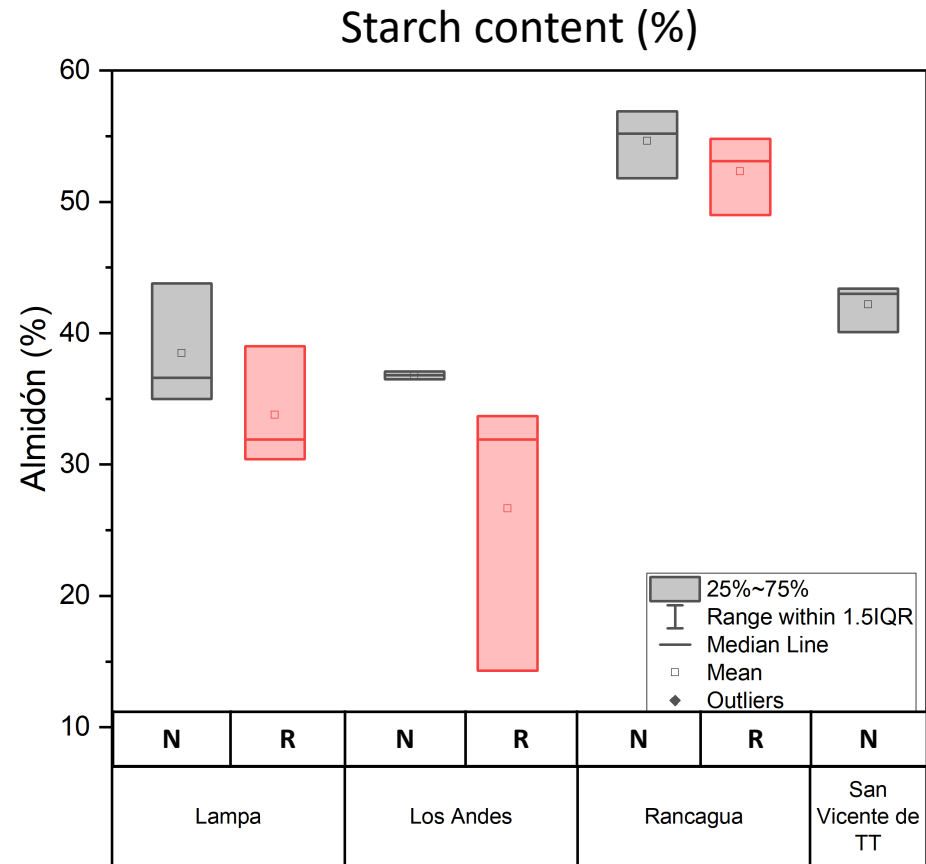
# Phloem radial length ( $\mu\text{m}$ )



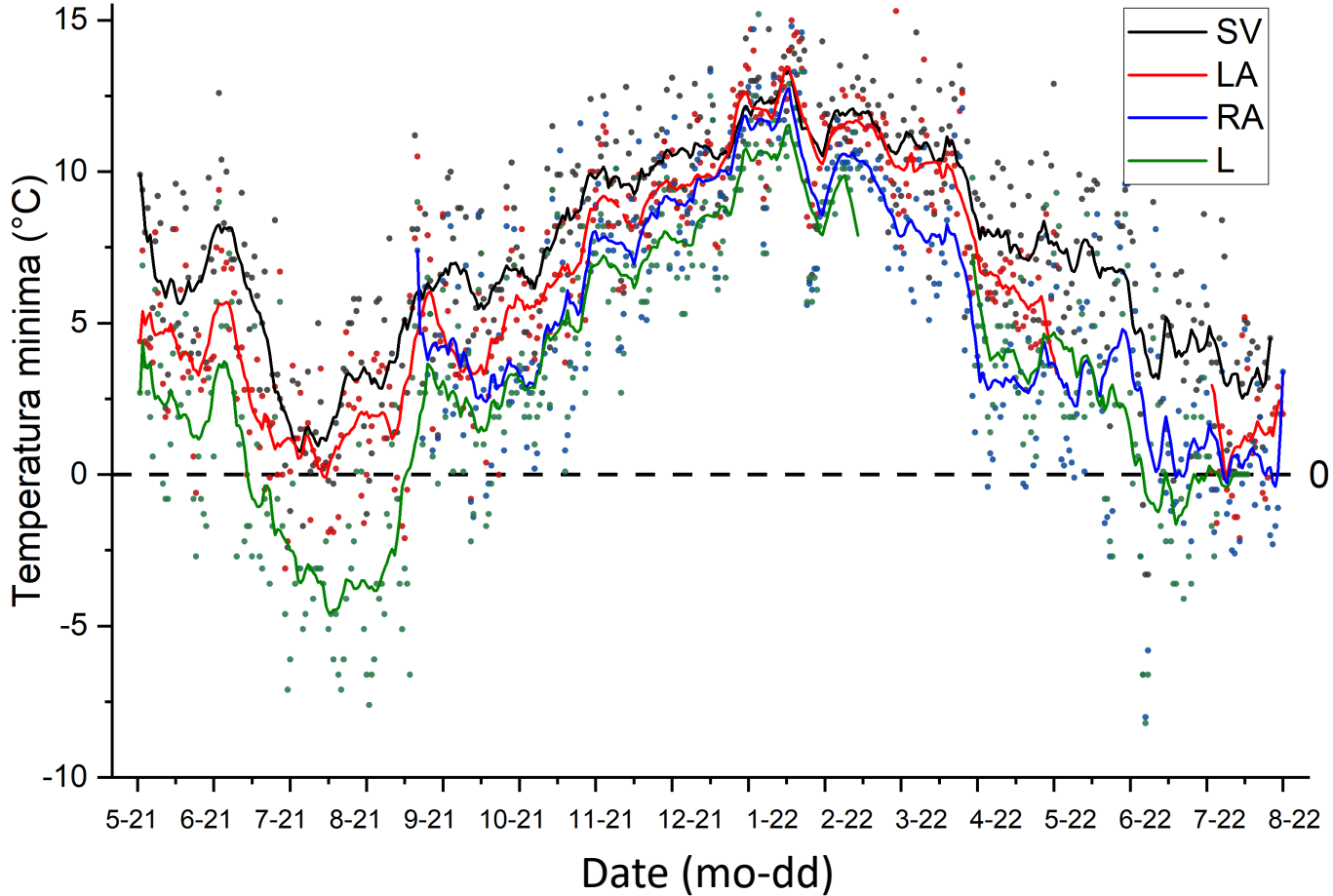
# Arginine storage in roots



# Starch storage in roots



Recorded **minimum temperatures** for the 2021 and 2022 Seasons. Each data point represents the daily minimum temperature, while the lines depict the moving averages.



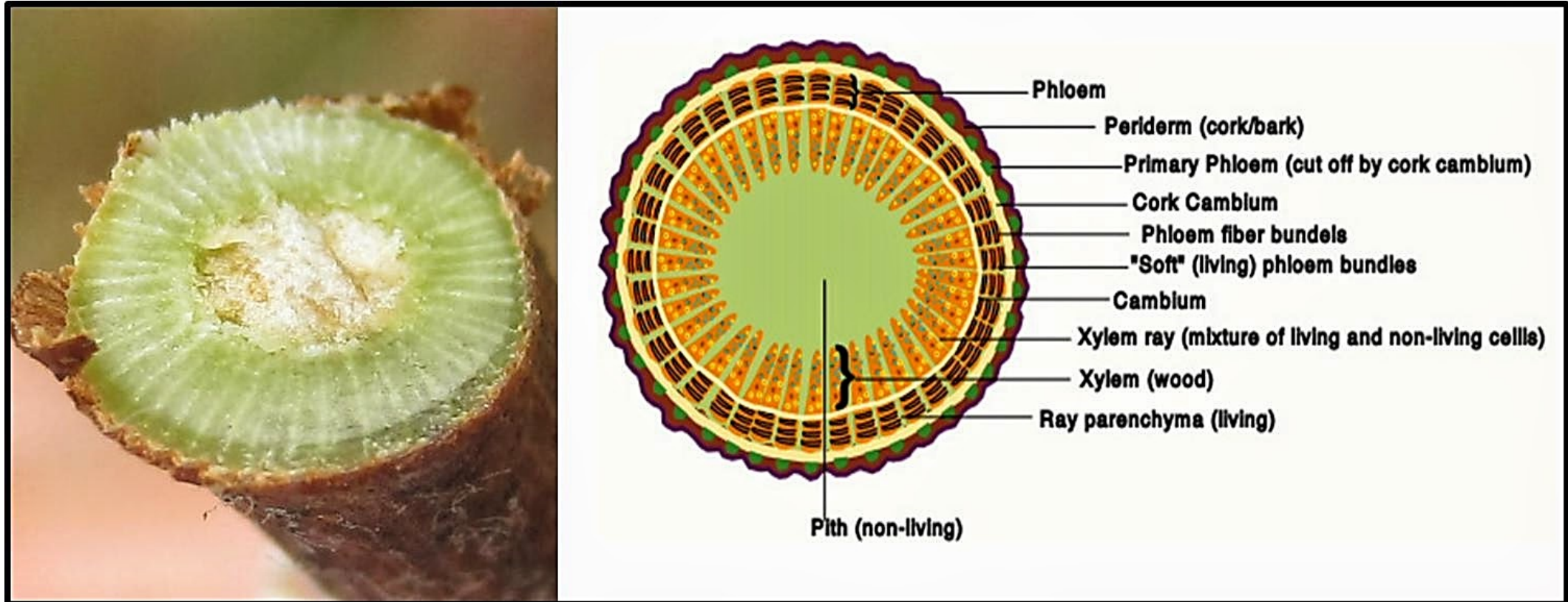
# Frost events and bud necrosis

- All vineyards exhibited necrosis in the primary buds, and the frost exacerbated this situation.
- Signs of frost injury can also be found in the upper section of the canes.
- Bud necrosis assessment
  - San Vicente: 14.8%
  - Los Andes: 16.7%
  - Rancagua: 16.7%
  - Lampa: 33.3%

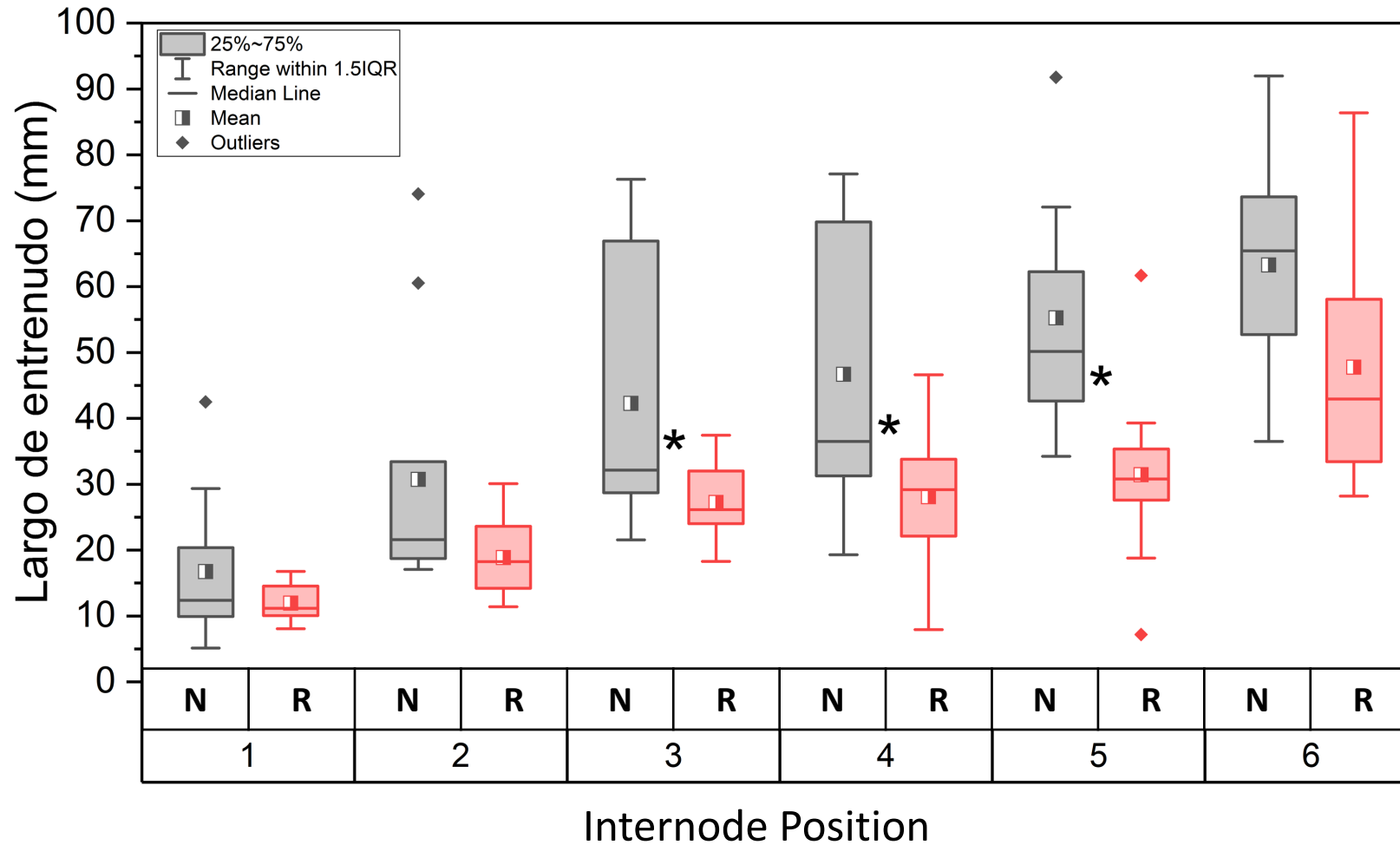


# Analysis of last season's wood

Polpaico 2023



# Internode length (mm)

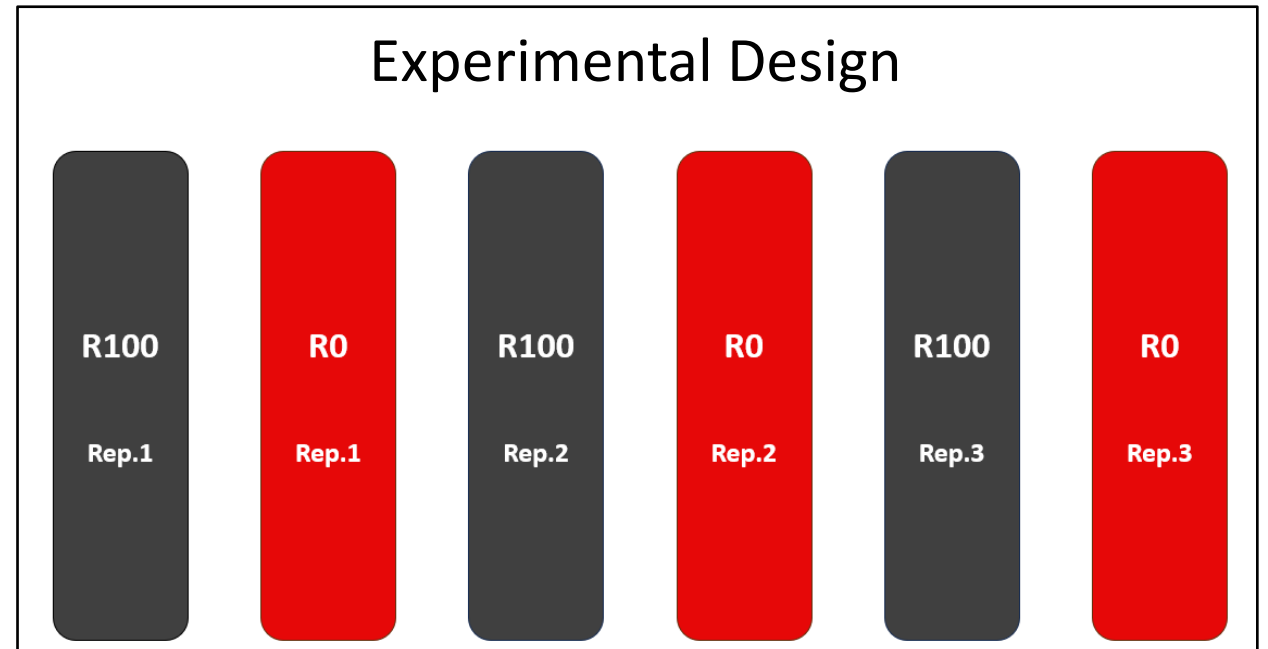


# Water deficit experiment

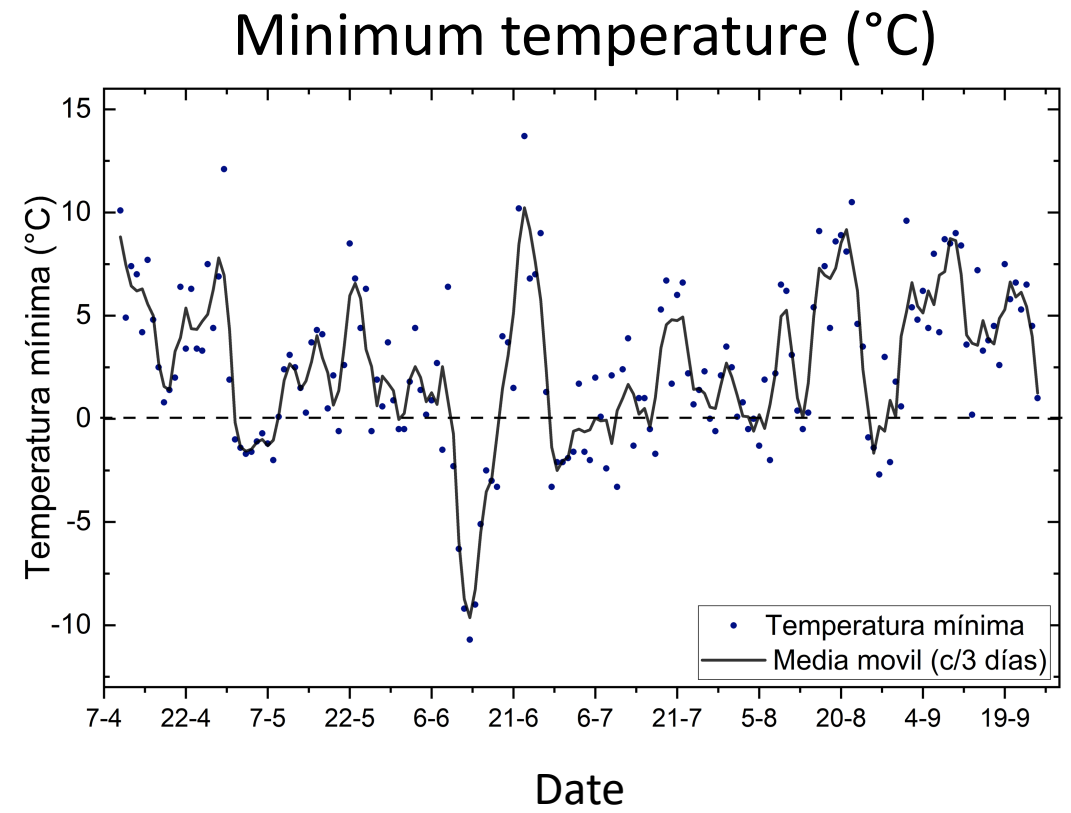
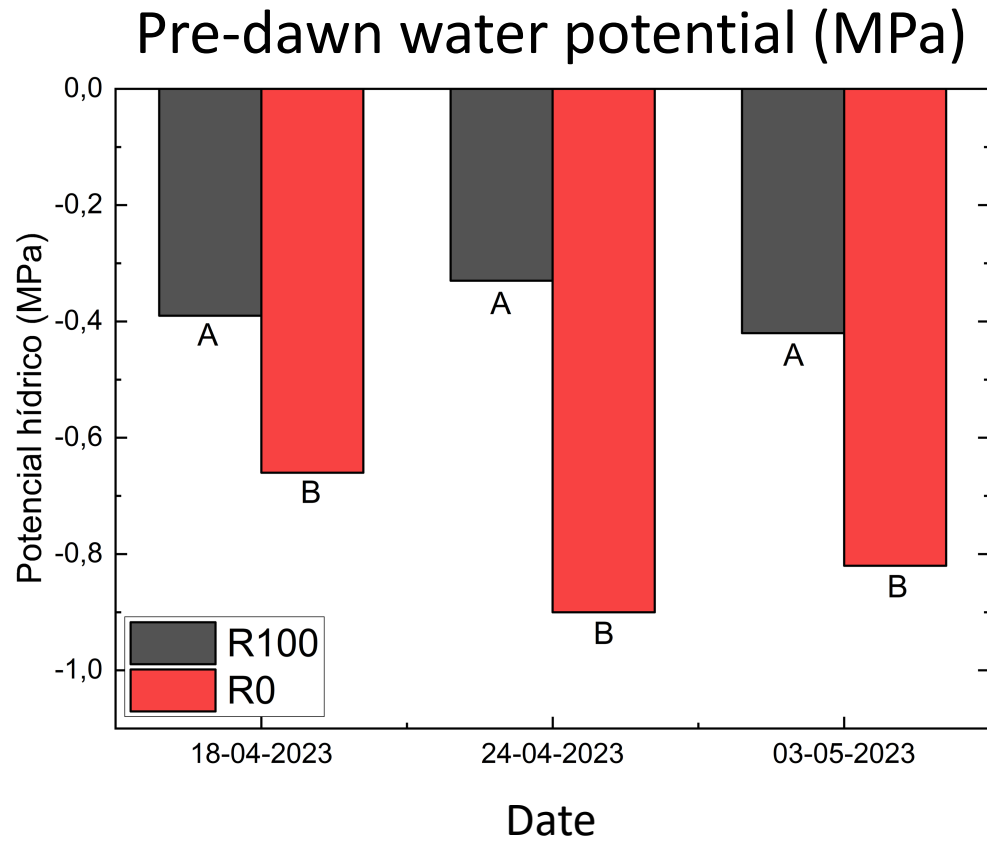
Harvest date: 20-Mar-2023

**Irrigation withholding: 03-Apr-2023**

First rain after treatment >2 mm:  
21-June



# Water deficit experiment



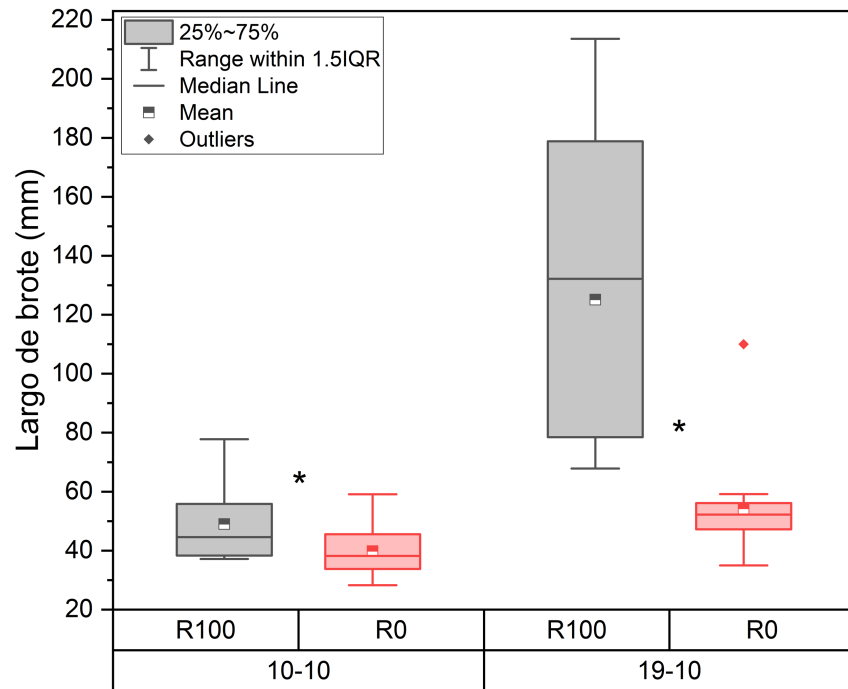
# Results from anatomy after pruning and freezing events

Xylem radial length ( $\mu\text{m}$ )	Polpaico	Condition	Mean $\pm$ St. error	P-value
	03-05-23	R100	1745 $\pm$ 90.5	0.6483
		R0	1819 $\pm$ 135.5	
	30-05-23	R100	2100 $\pm$ 153.4	0.0348*
		R0	2745 $\pm$ 243.4	
	25-07-23	R100	2260 $\pm$ 138.7	0.0027*
R0		3078 $\pm$ 196.1		

Phloem radial length ( $\mu\text{m}$ )	Polpaico	Condition	Mean $\pm$ St. error	P-value
	03-05-23	R100	336 $\pm$ 21.7	0.6057
		R0	445 $\pm$ 56.2	
	30-05-23	R100	431 $\pm$ 25.3	0.0823
		R0	455 $\pm$ 38.3	
	25-07-23	R100	501 $\pm$ 25.3	0.5621
R0		483 $\pm$ 19.2		

# Water deficit and RGS

## Shoot length (mm)



## Irrigated (R100)



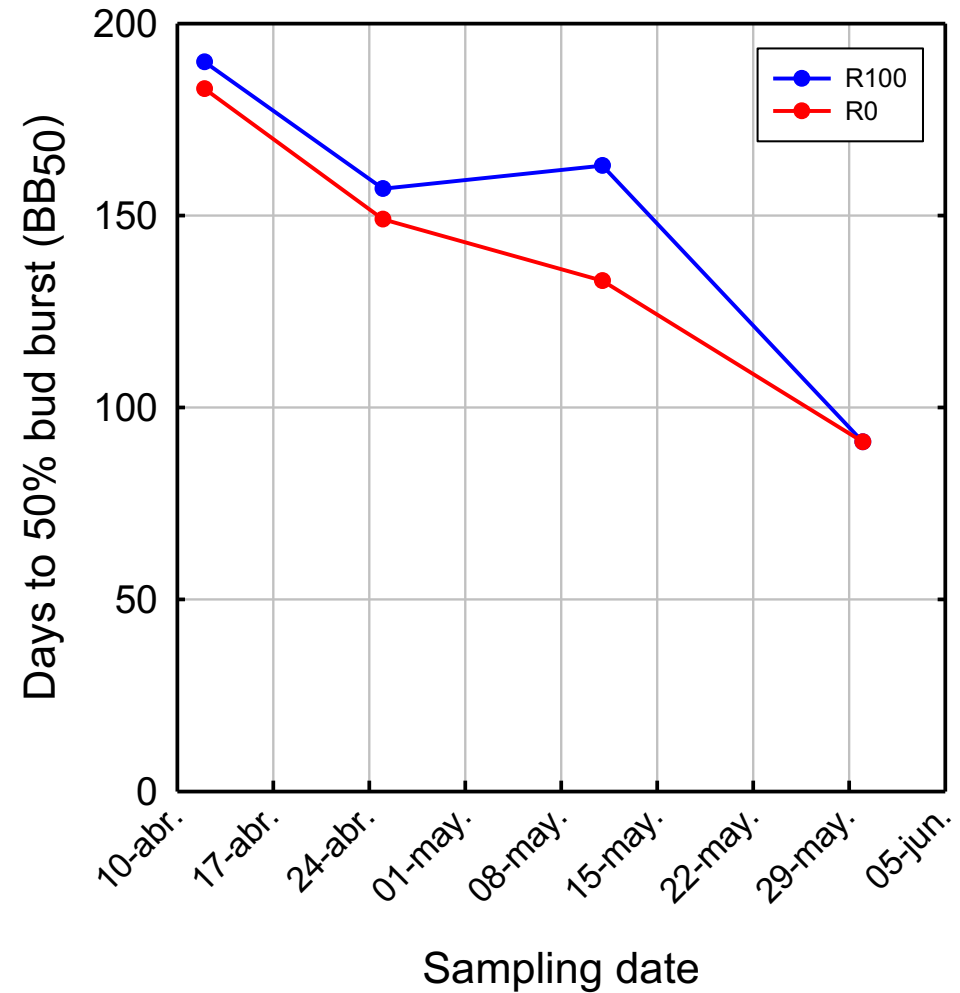
## Water stress (R0)



21-Nov-2023

# Depth of dormancy test

The depth of dormancy of single-node explants collected in 2023 and grown in forcing conditions, expressed as the time to 50% bud burst ( $BB_{50}$ ;  $n=50$ )



Final comments



# Restricted spring growth syndrome

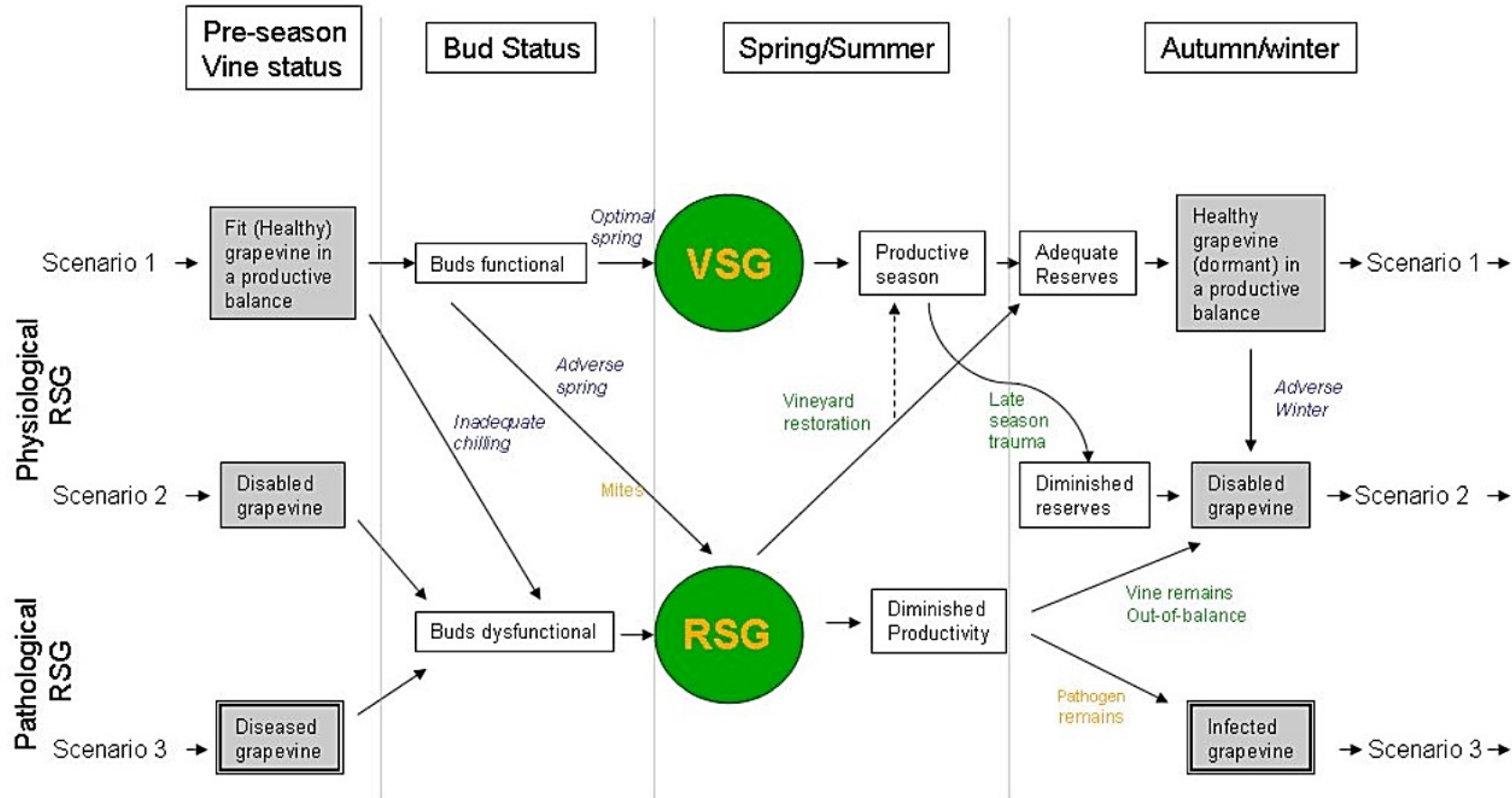


Figure 2. A notional summary of interactive factors that either sustain Vigorous Spring Growth (VSG) or lead to Restricted Spring Growth (RSG).

# Acknowledgment

## S

- **Bastián Silva** Ing. Agr., M.S.
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- Jaime Schmitz
- Dr. Pietro Scafidi

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**FRESH™**

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