

# **CURRENT UNDERSTANDING OF GRBV INFECTION ON GRAPEVINE PHYSIOLOGY**

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**Grace Mallon**

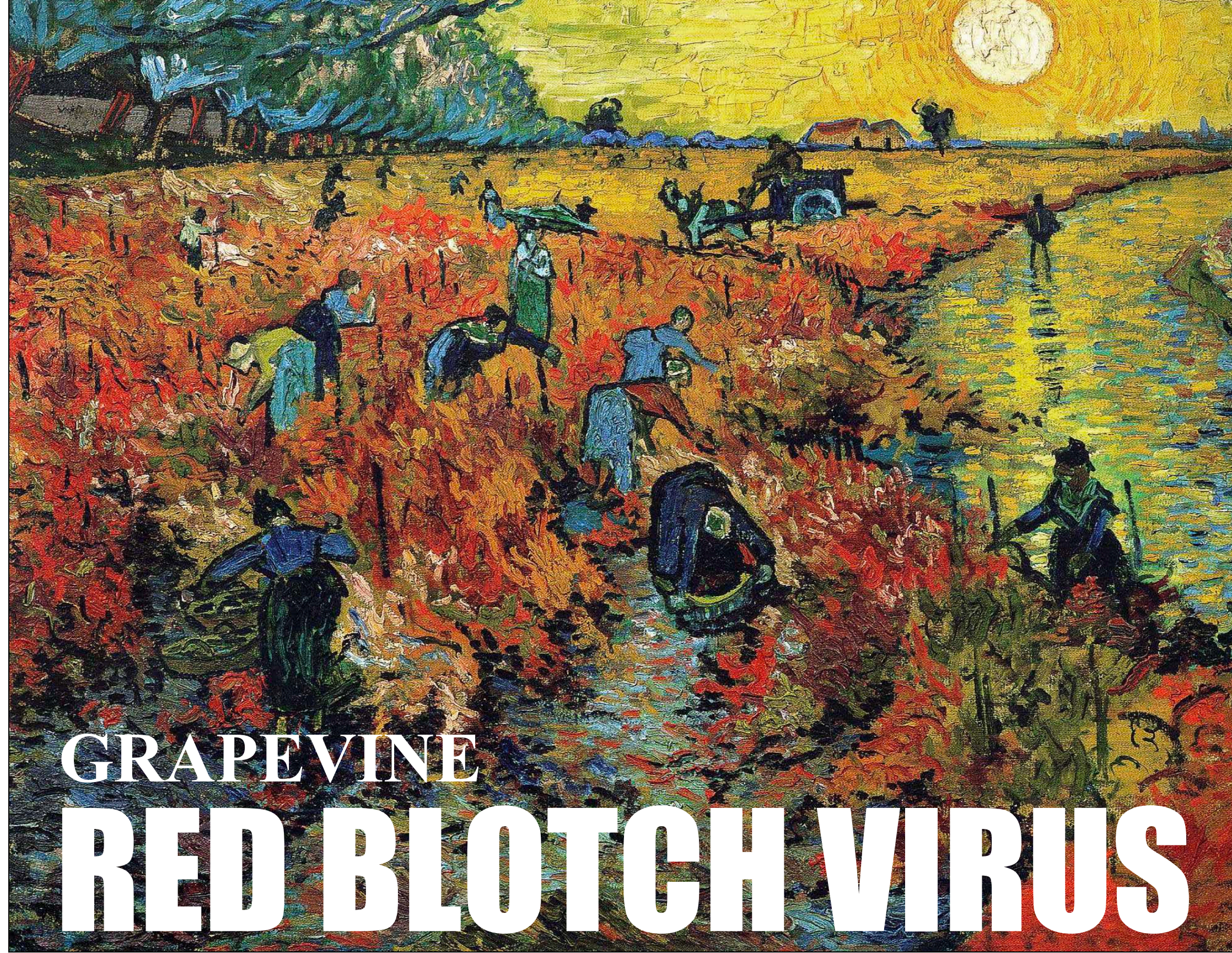
@GraceMallon3



PhD student, c.2020: Here's a limited argument I made based on years of specialized research. Hope it's OK 😞







GRAPEVINE  
**RED BLOTCH VIRUS**



# GRBD in context

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<b>Disease</b>	<b>First desc.</b>	<b>Graft trans.</b>	<b>Virus ID</b>	<b>Vector trans.</b>	<b>Diagnostic assays</b>	<b>Koch's postulates</b>
Fanleaf	1841	1962	1960	1958	1960	1962
Leafroll	1905	1935	1979	1984	1984	N/A
Red Blotch	2008	2013	2012	2016	2012	2018

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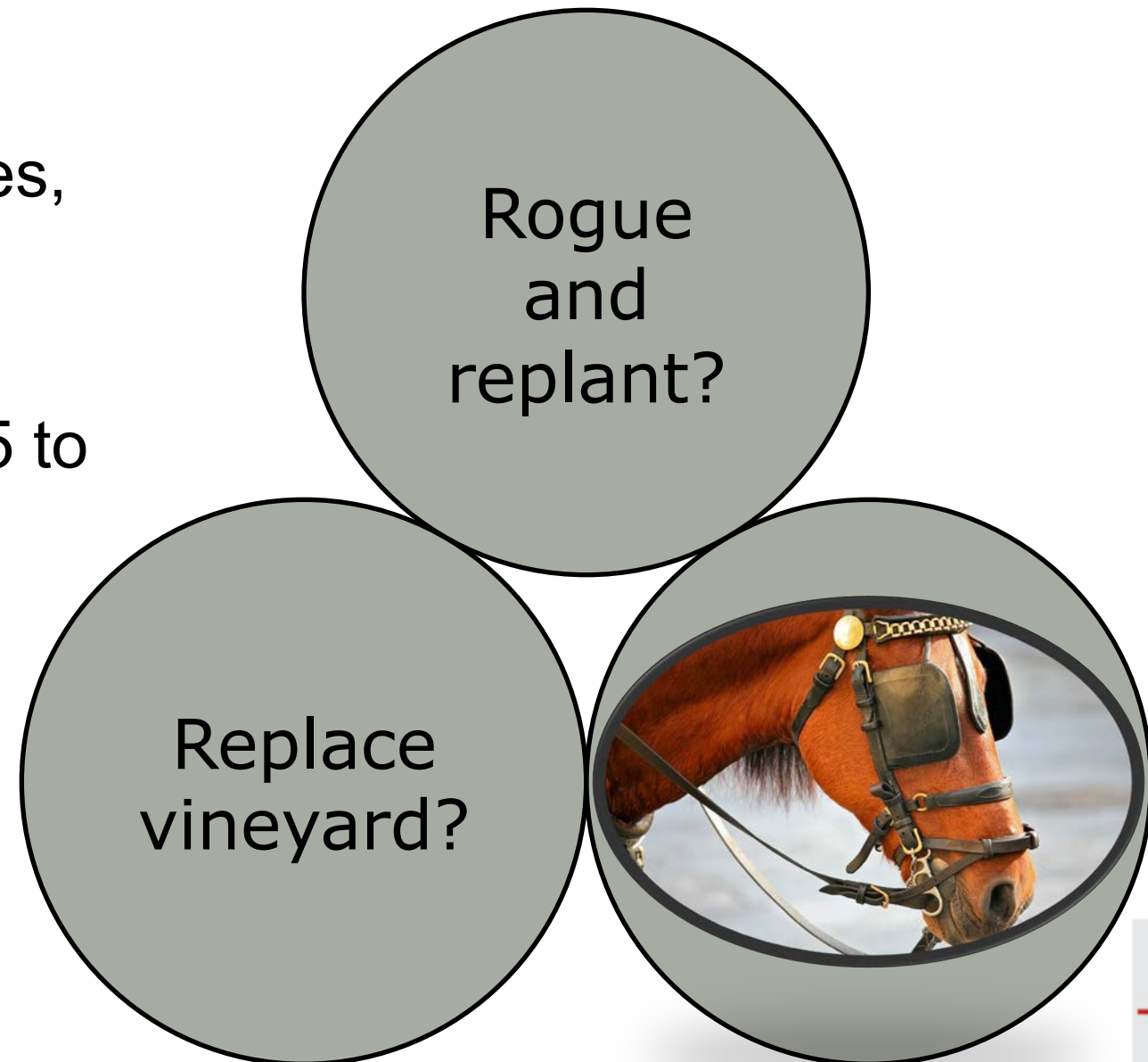
Slide courtesy of Dr. Deborah Golino and Dr. Marc Fuchs



# Economic impact of GRBD

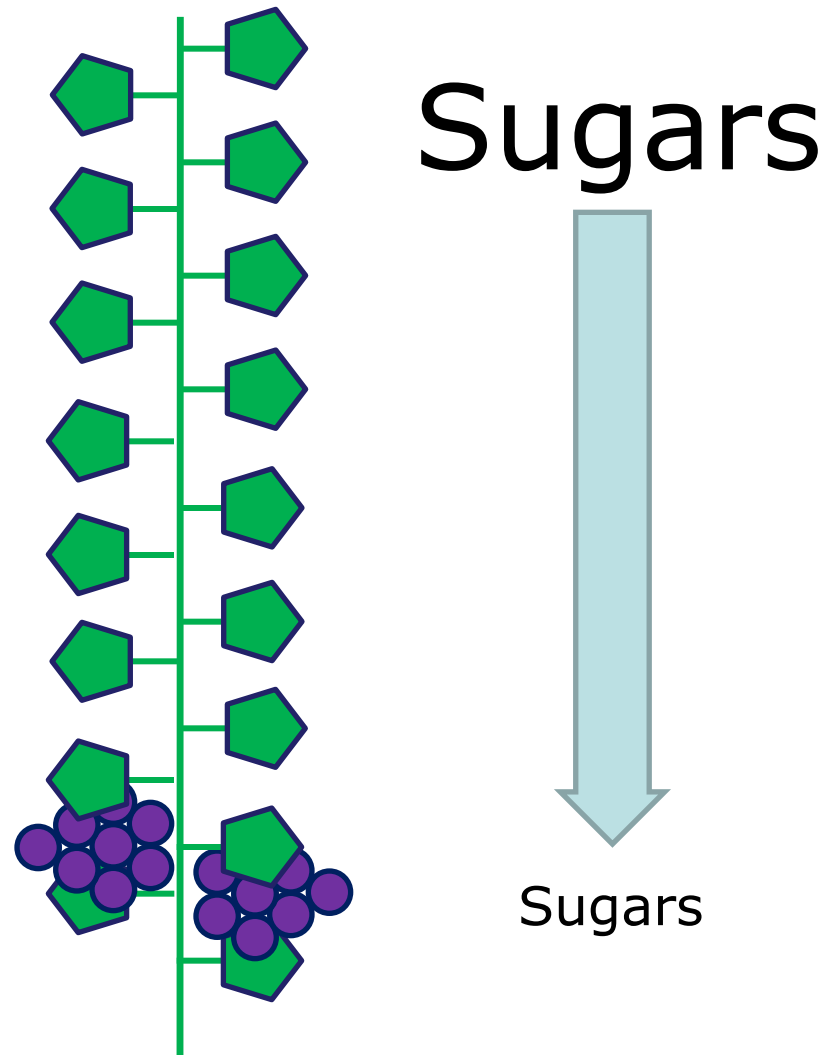
- Assume fixed spread rate, but variable incidences, price penalties, and vineyard ages.
- Estimated economic impact: \$895 to \$27,734/acre over 25 years

**<30% incidence = RR**  
**>30% incidence = RPL**



# Reduction in sugar translocation linked to impaired ripening

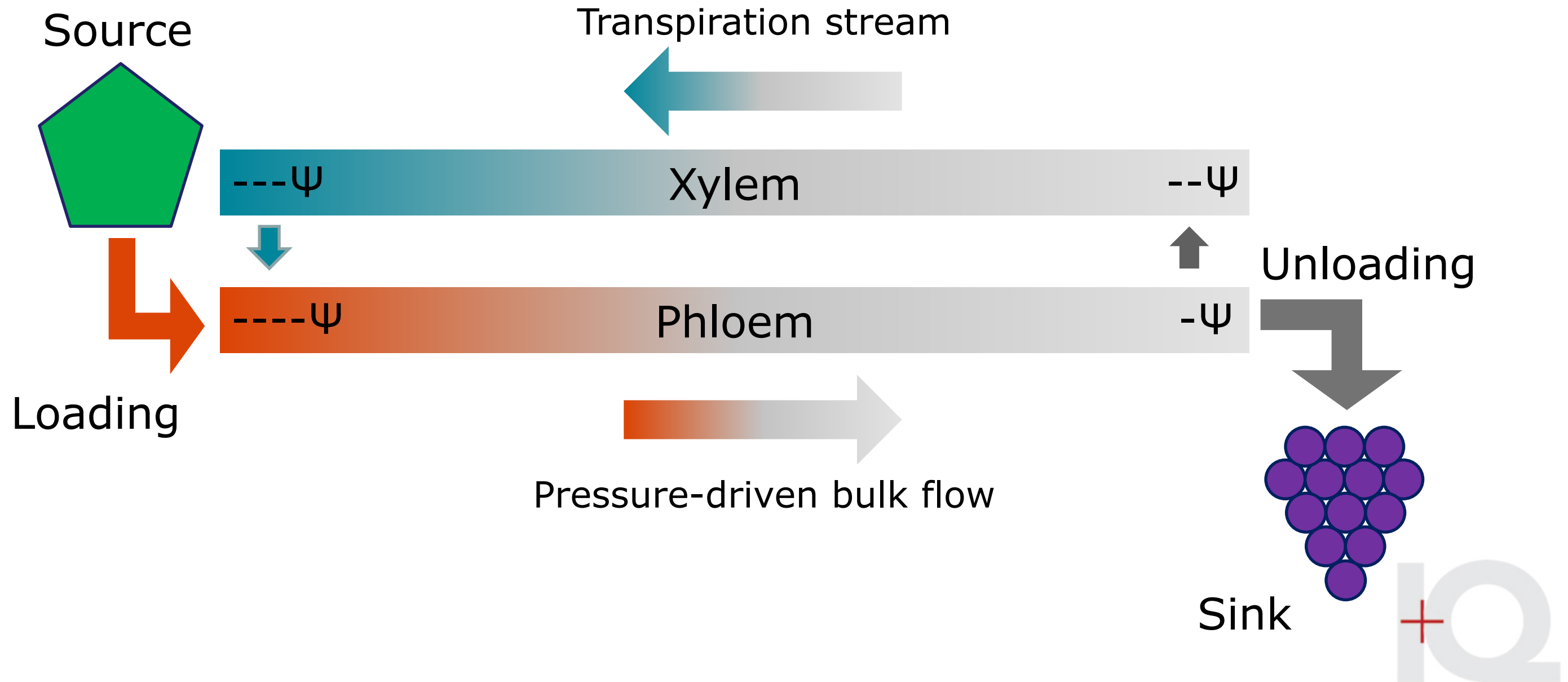
GRBV-



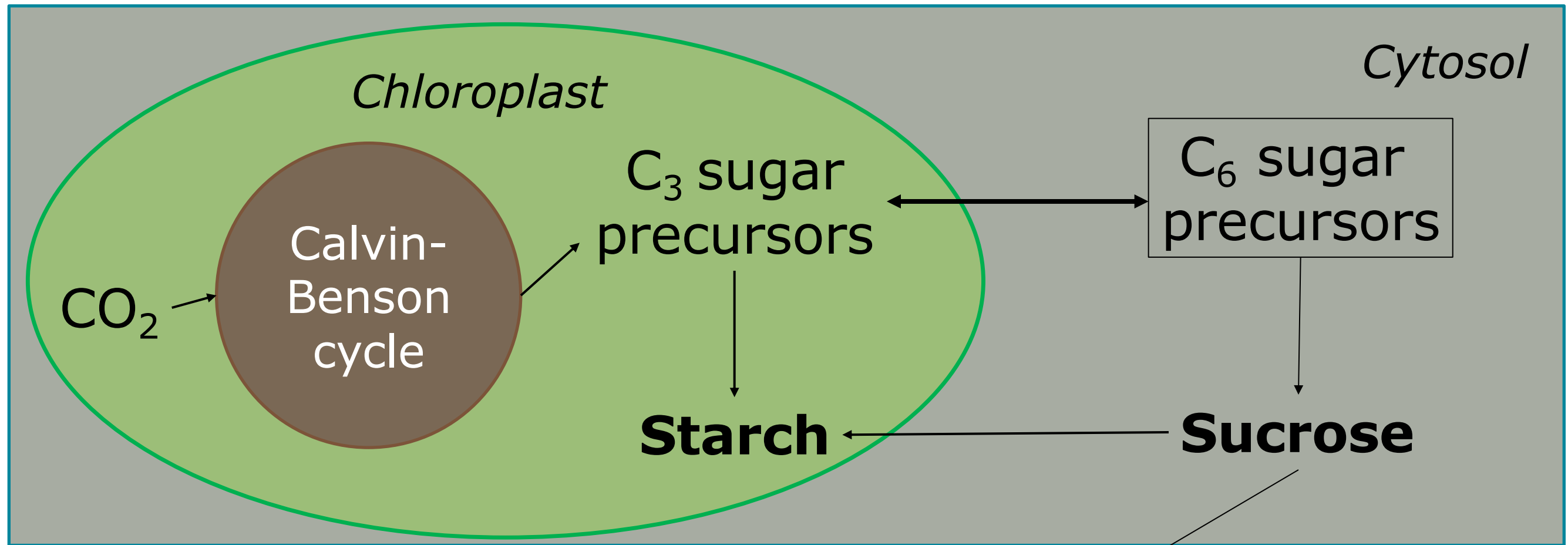
*Martínez-Lüscher et al. (2019); Wallis and Sudarshana (2016); Poojari et al. (2013)*



# Vascular system physiology



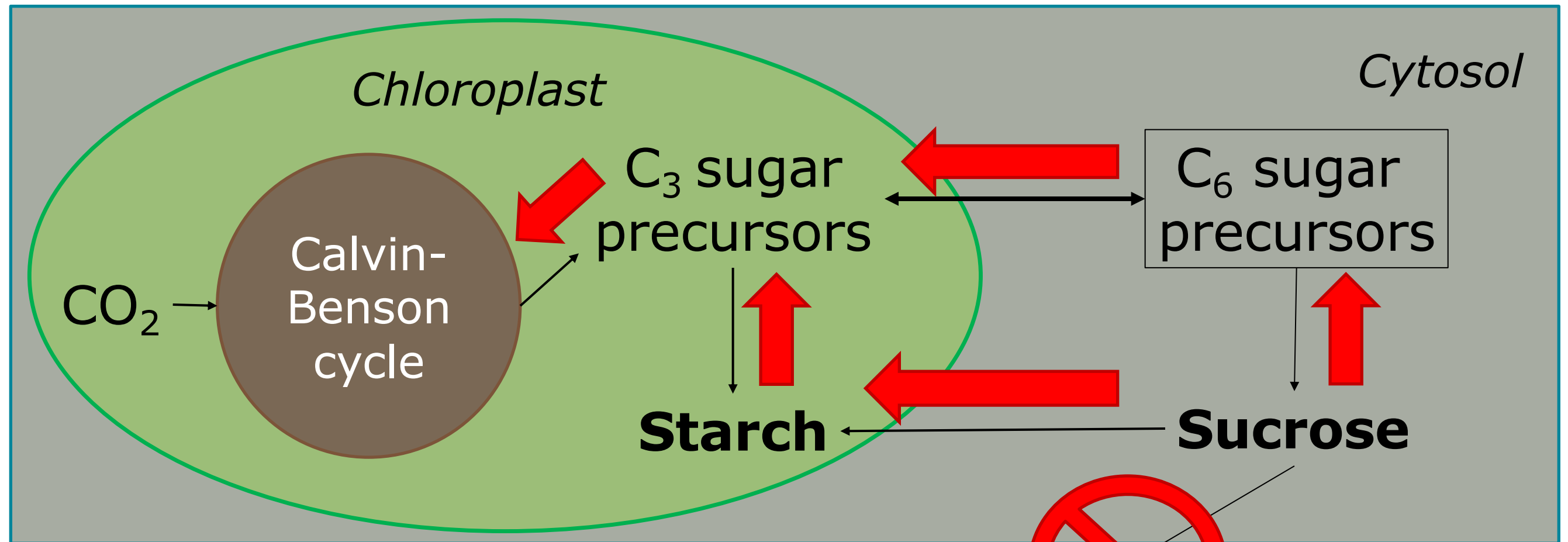
# Sucrose biosynthesis and signaling



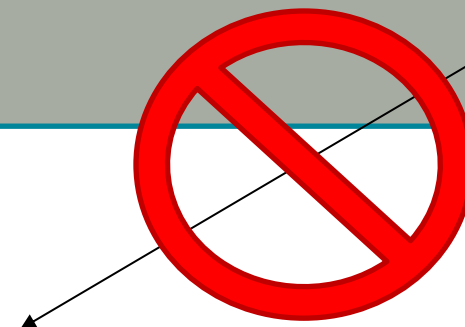
Phloem  
transport



# Feedback inhibition from GRBV



Phloem  
transport

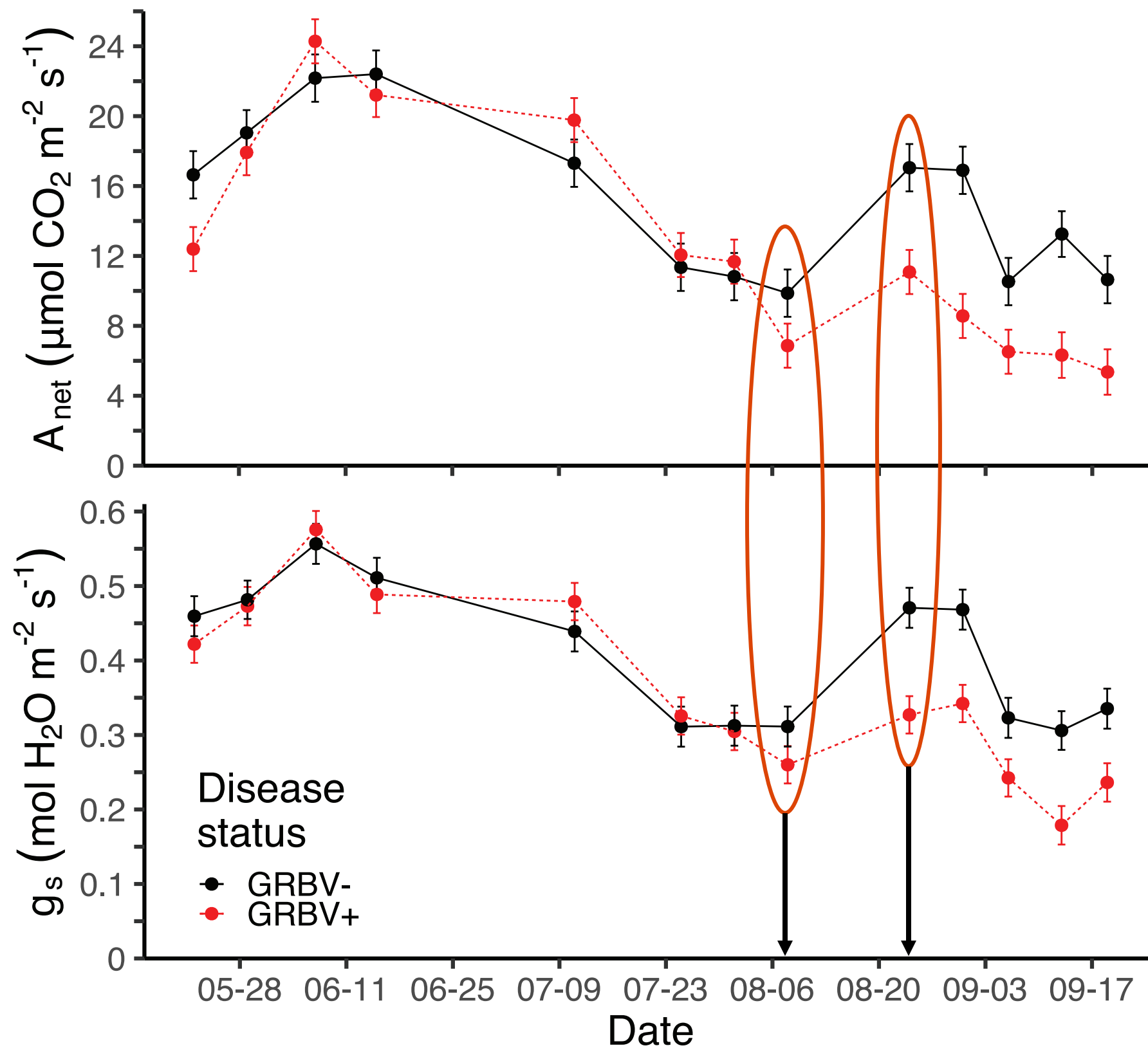


# Backup of sugars in leaves

Date	GRBV	Sugars	Starch
----- <i>mg/cm<sup>2</sup></i> -----			
8/06/19 ~veraison	(+)	6.53	1.82 b
	(-)	6.90	1.48 a

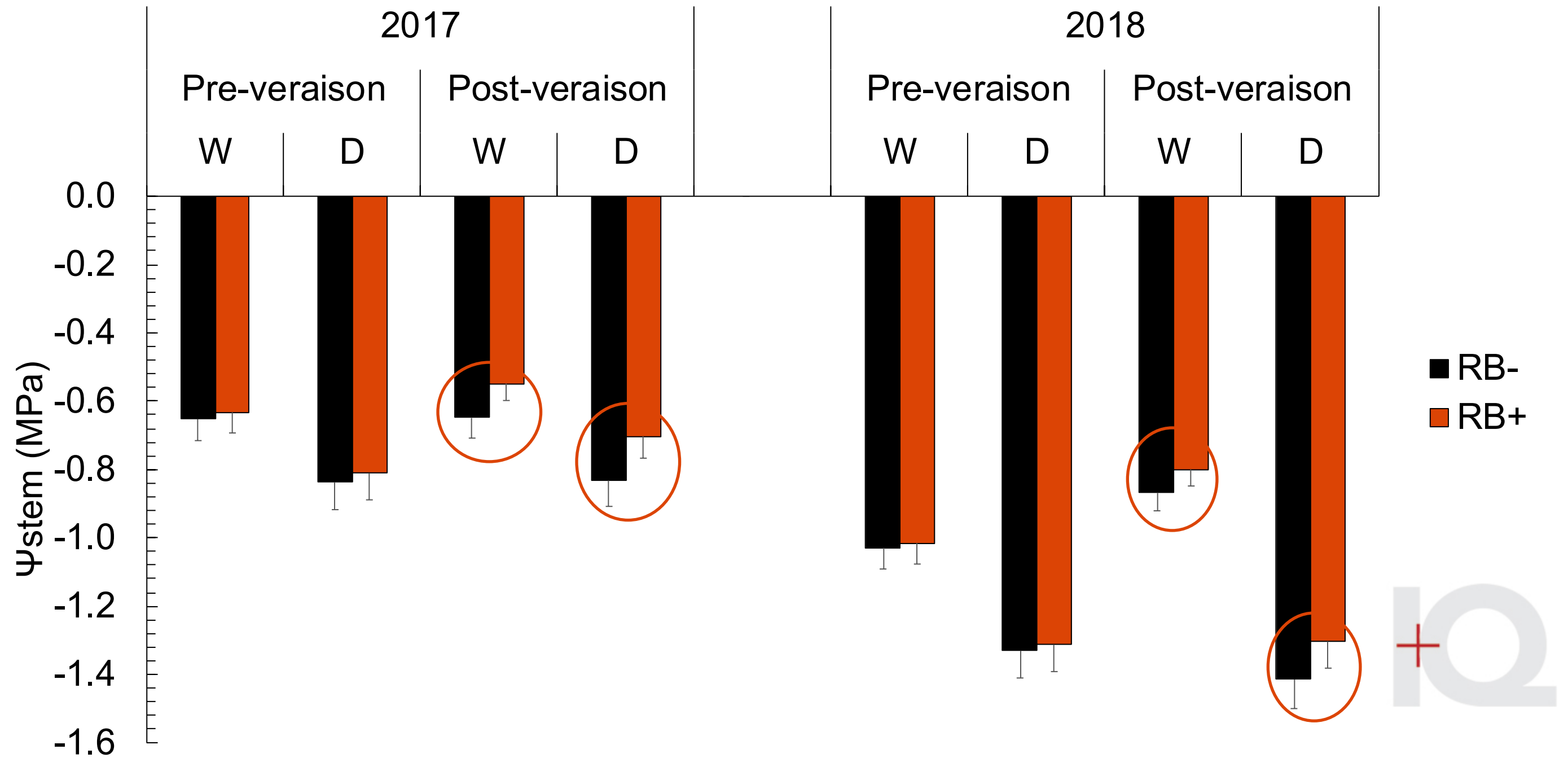






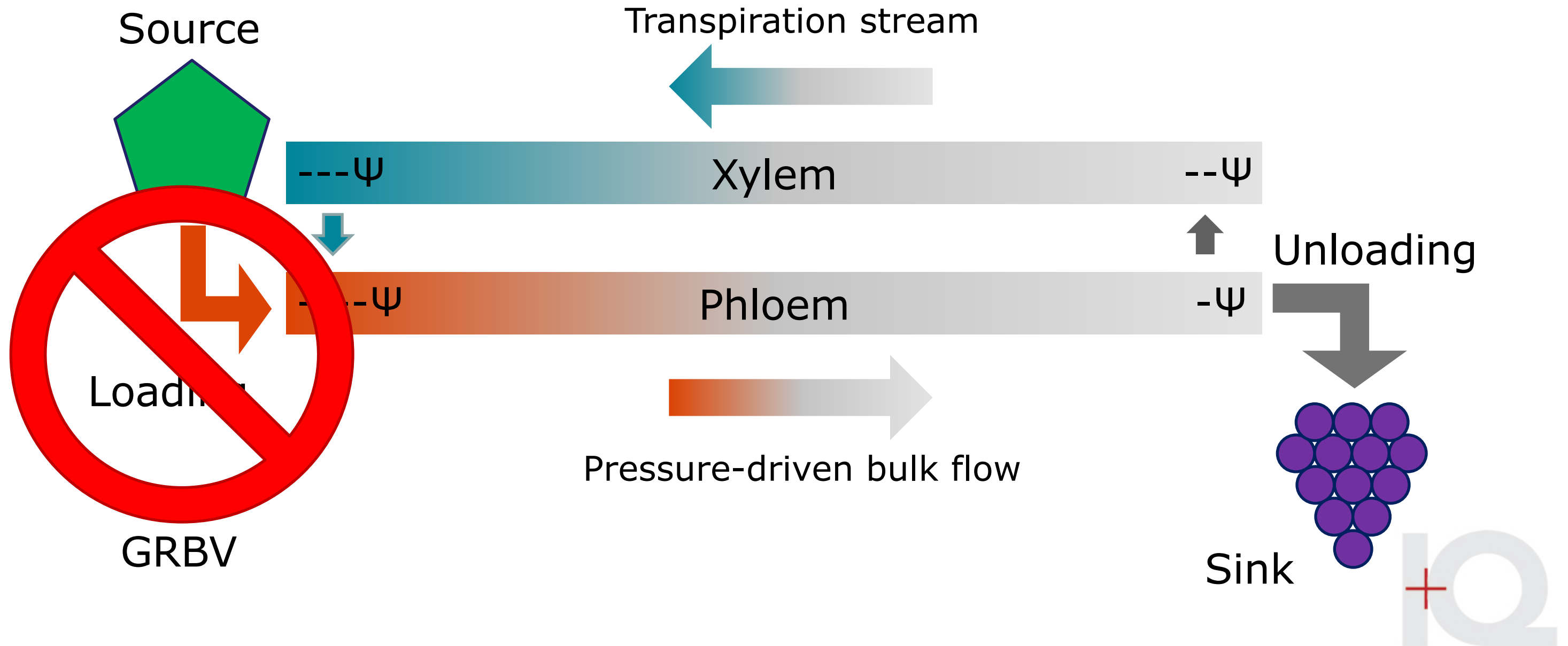
Gas  
exchange  
reduced at  
(or just after)  
veraison

# Increase in postveraison water status



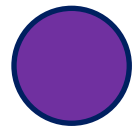


# GRBV affects source first

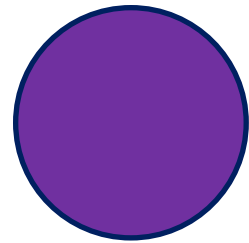


# Sink strength

**Sink size**  
(total biomass)

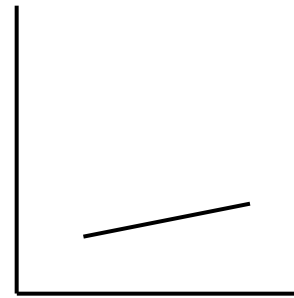


vs.

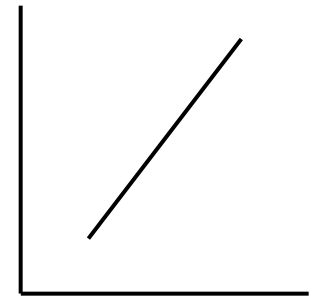


\*

**Sink activity**  
(rate of sugar uptake)

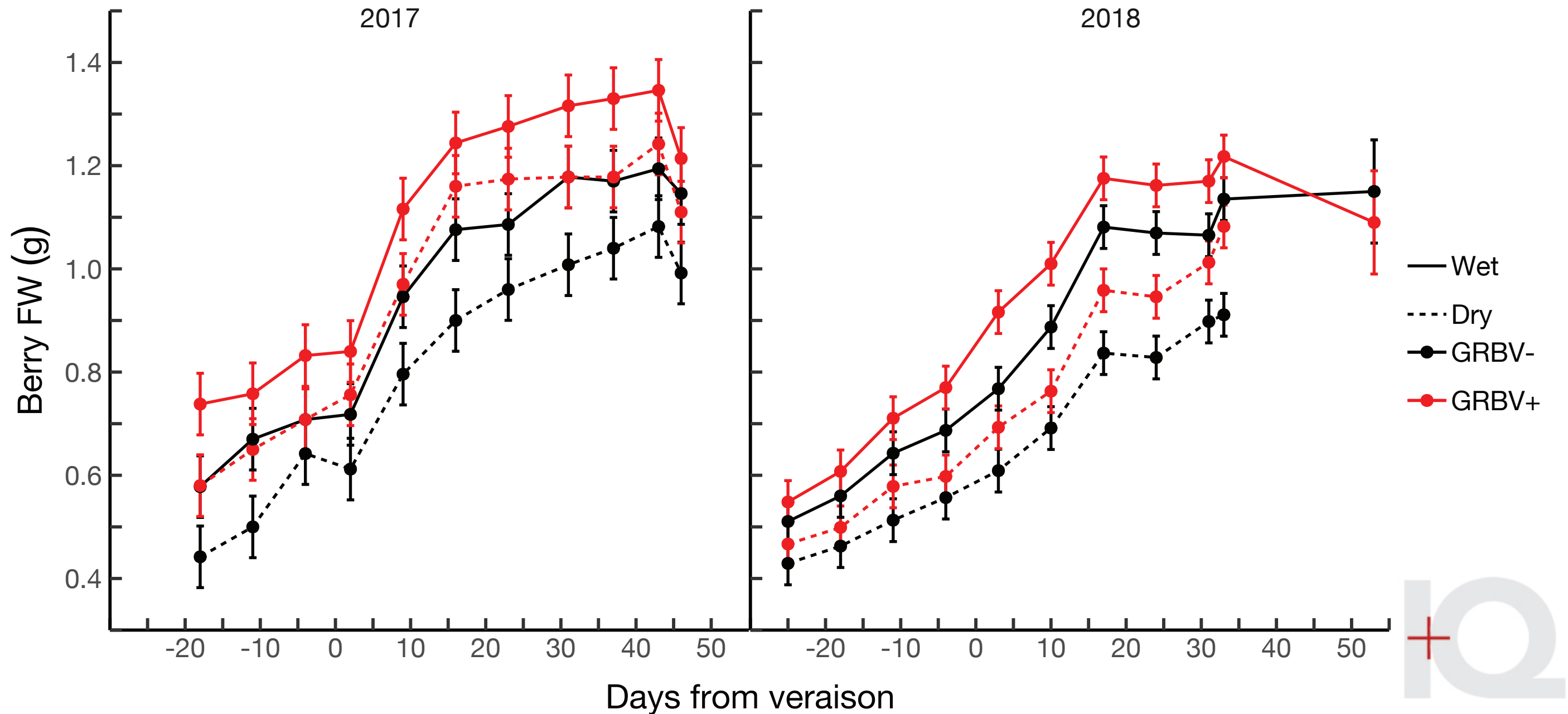


vs.

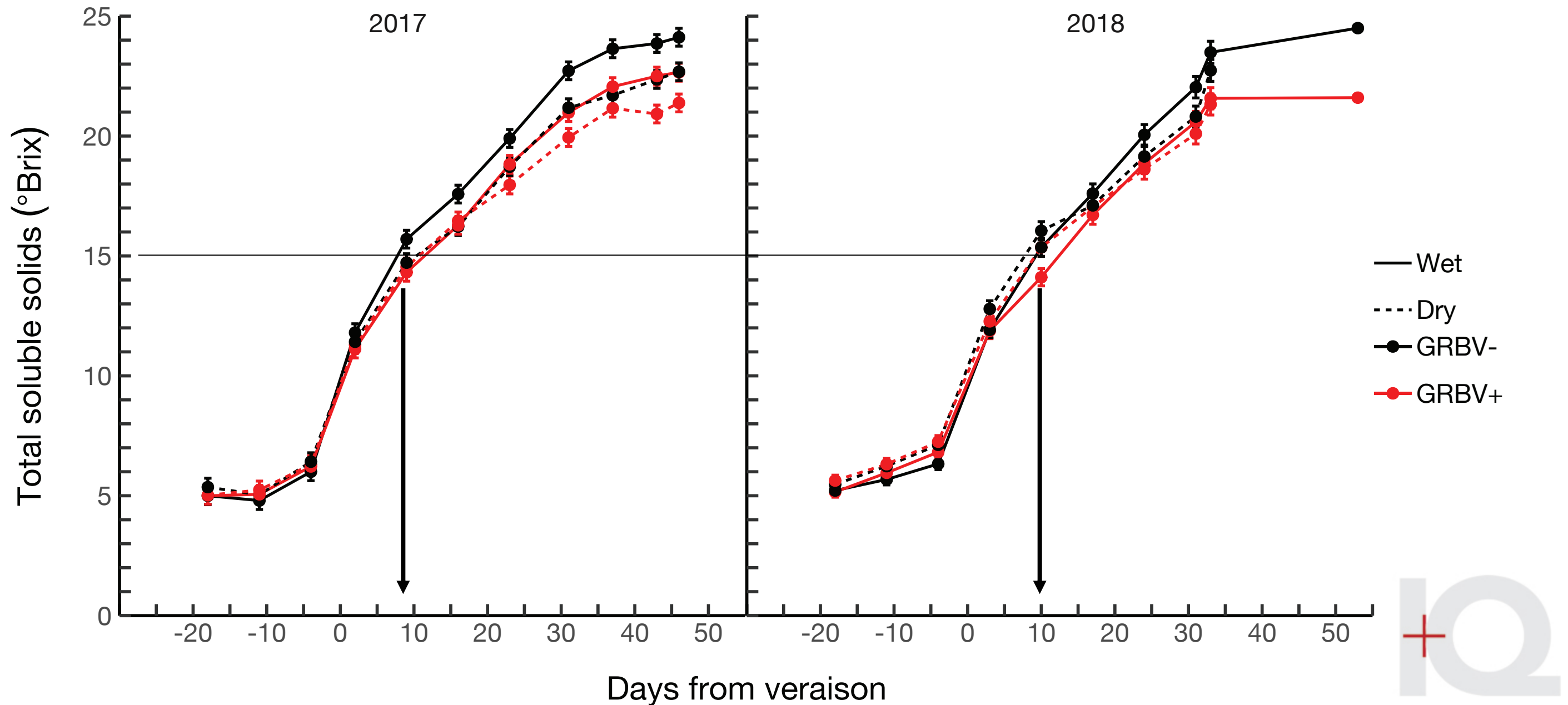




# Larger berries in GRBV+ vines

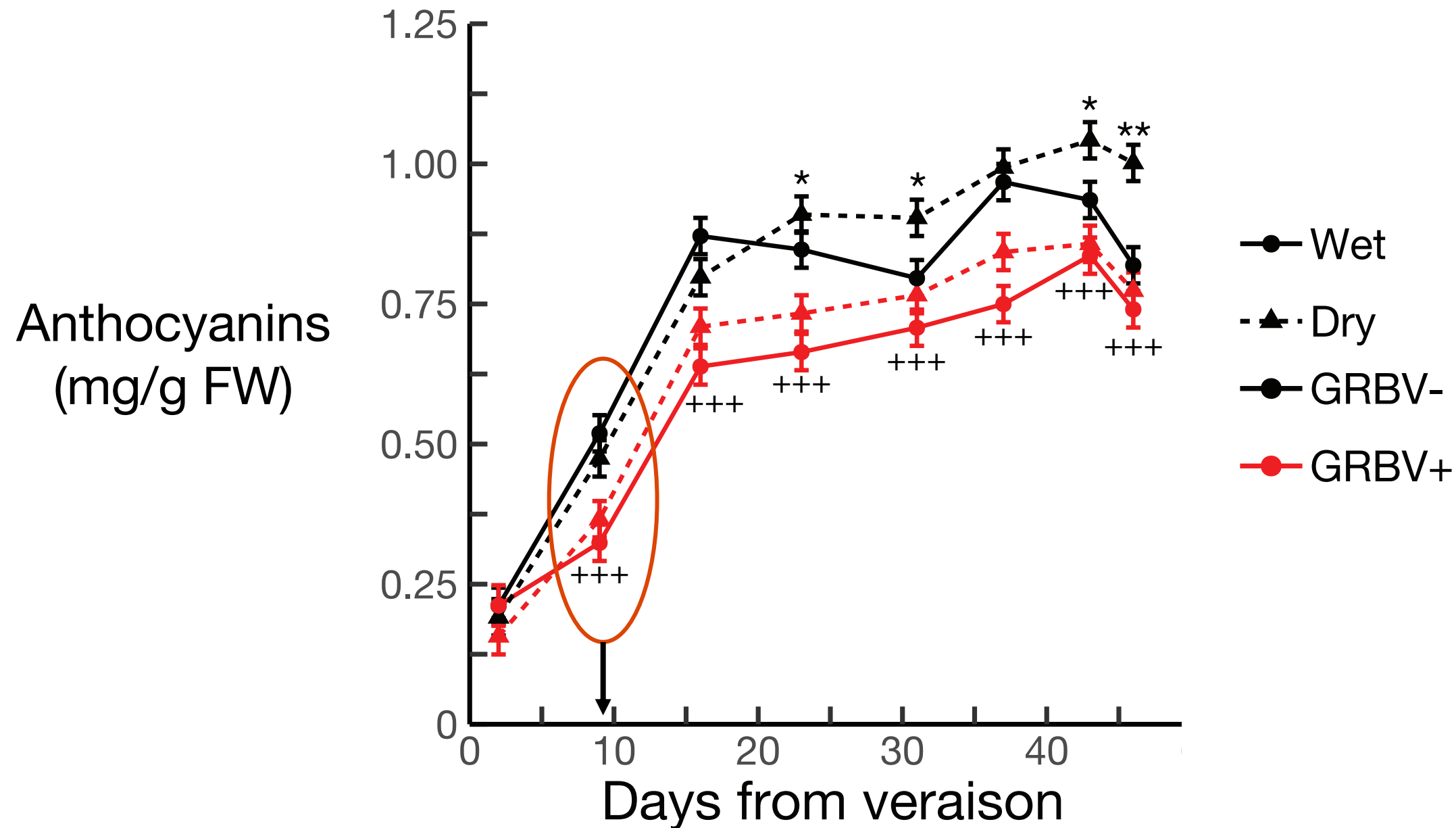


# Ripening slows after 15° Brix

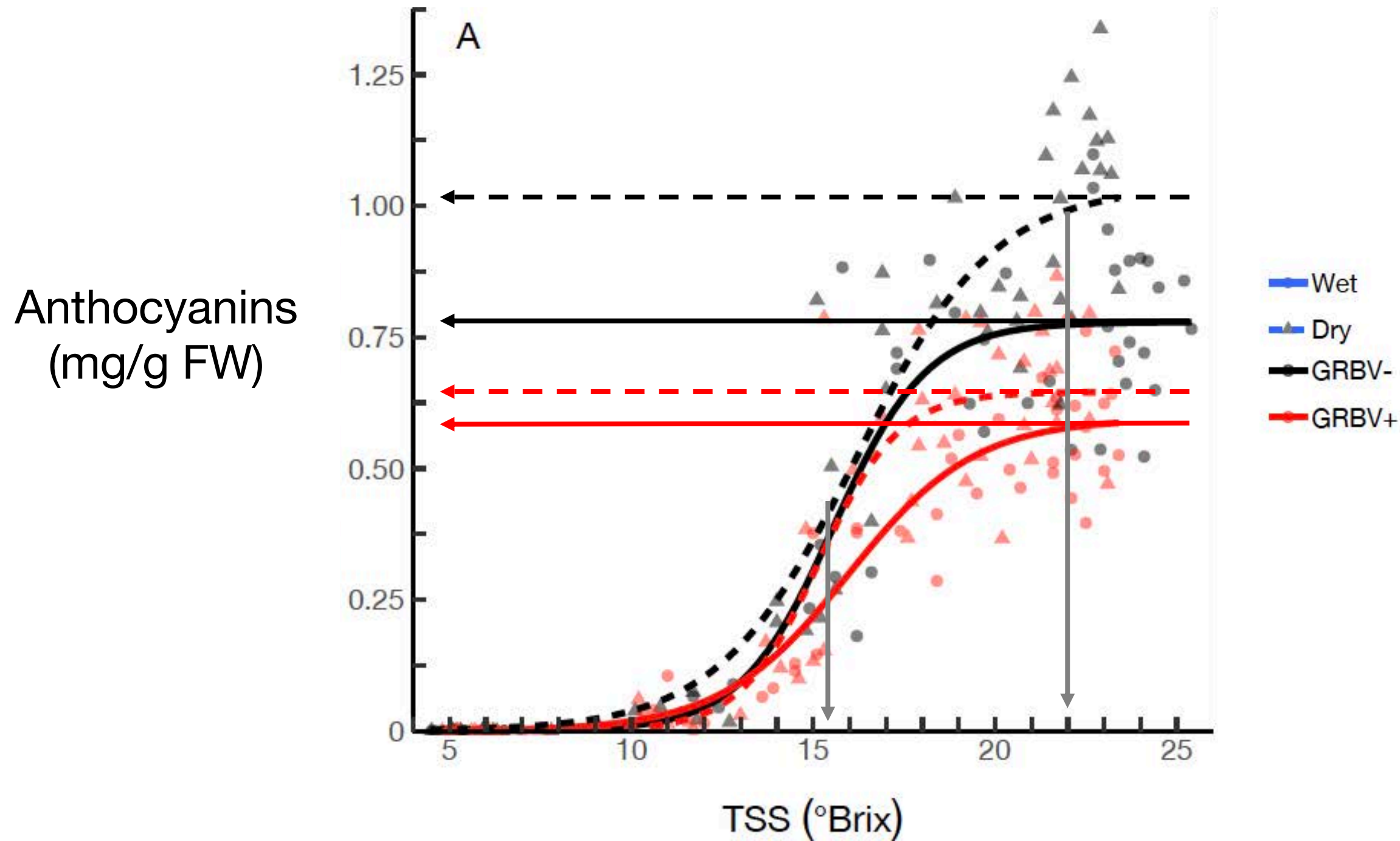




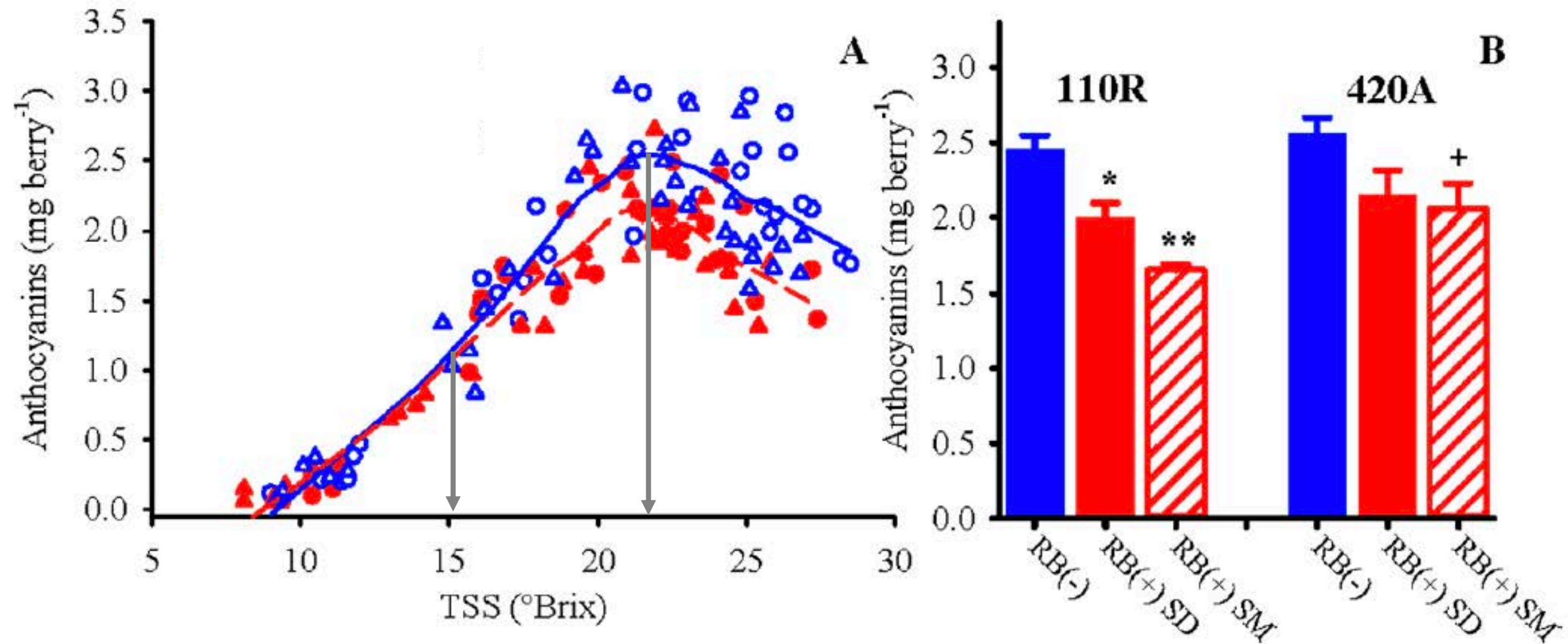
# Anthocyanin development over time



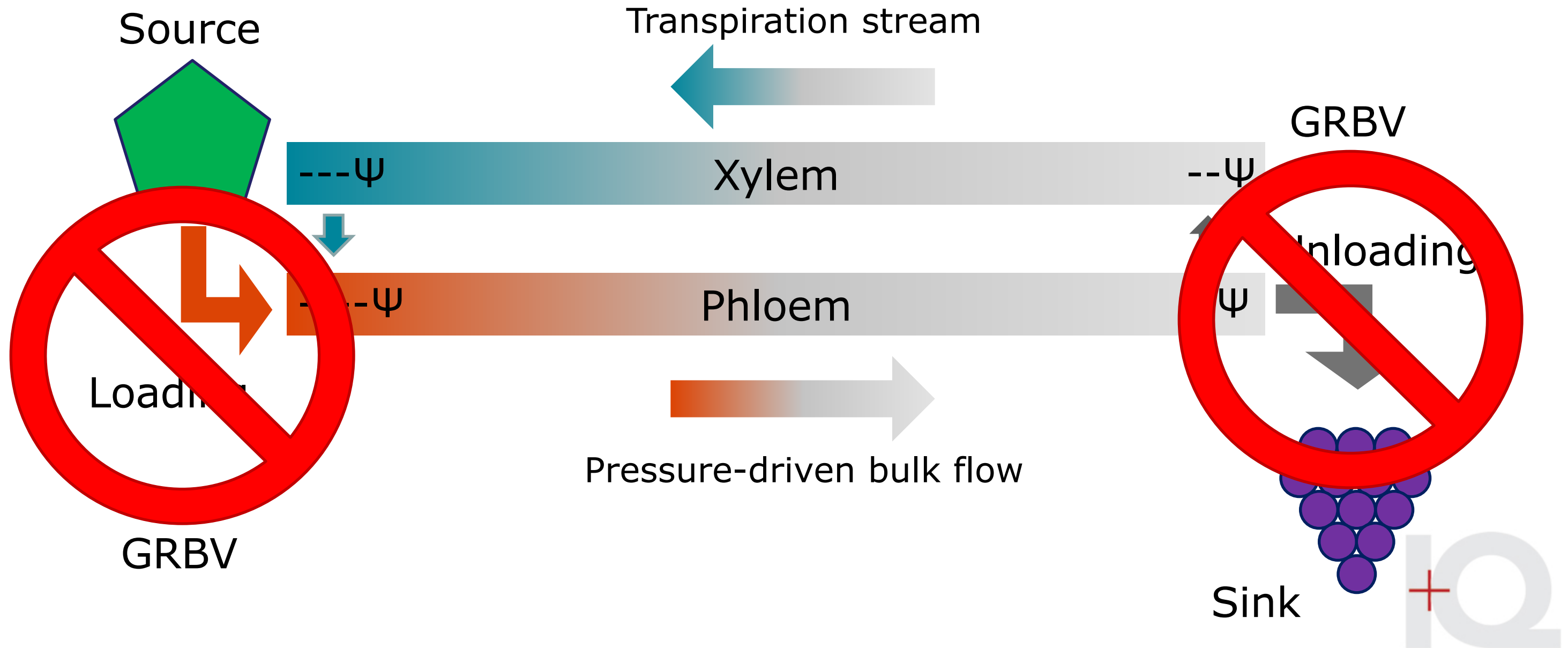
# GRBV limits color development



# Extended hangtime doesn't help



# GRBV effects on sugar metabolism





# Sugars are long-distance signal



*Blanco-Ulate et al. (2017)*

“Sucrose transport acts...as a long-distance signal that promotes developmental responses through regulation of hormonal responses at the sink level.”  
(Taiz et al. 2015, pg. 240)

“We conclude that **GRBV infections disrupt normal berry development** and stress responses **by altering transcription factors and hormone networks**, which result in the inhibition of ripening pathways involved in the generation of color, flavor, and aroma compounds.”  
(Blanco-Ulate et al. 2017)



# Short-term effects of GRBV infection

## Backup of sugars in leaves

- Feedback inhibition of photosynthesis

## Reduced CO<sub>2</sub> assimilation

- Stomatal closure
- Anthocyanin synthesis in leaves

## Higher vine water status

Bigger berries



# Short-term effects of GRBV infection

## Reduced sink strength

Reduced Brix in  
berries

## Inhibition of secondary metabolism

Genetic level  
control...

## Reduced fruit quality

Less \$\$\$  
Poor wine quality



# Long-term effects of GRBV infection

**Reduced allocation to storage sinks**

**Reduction in vine productivity?**

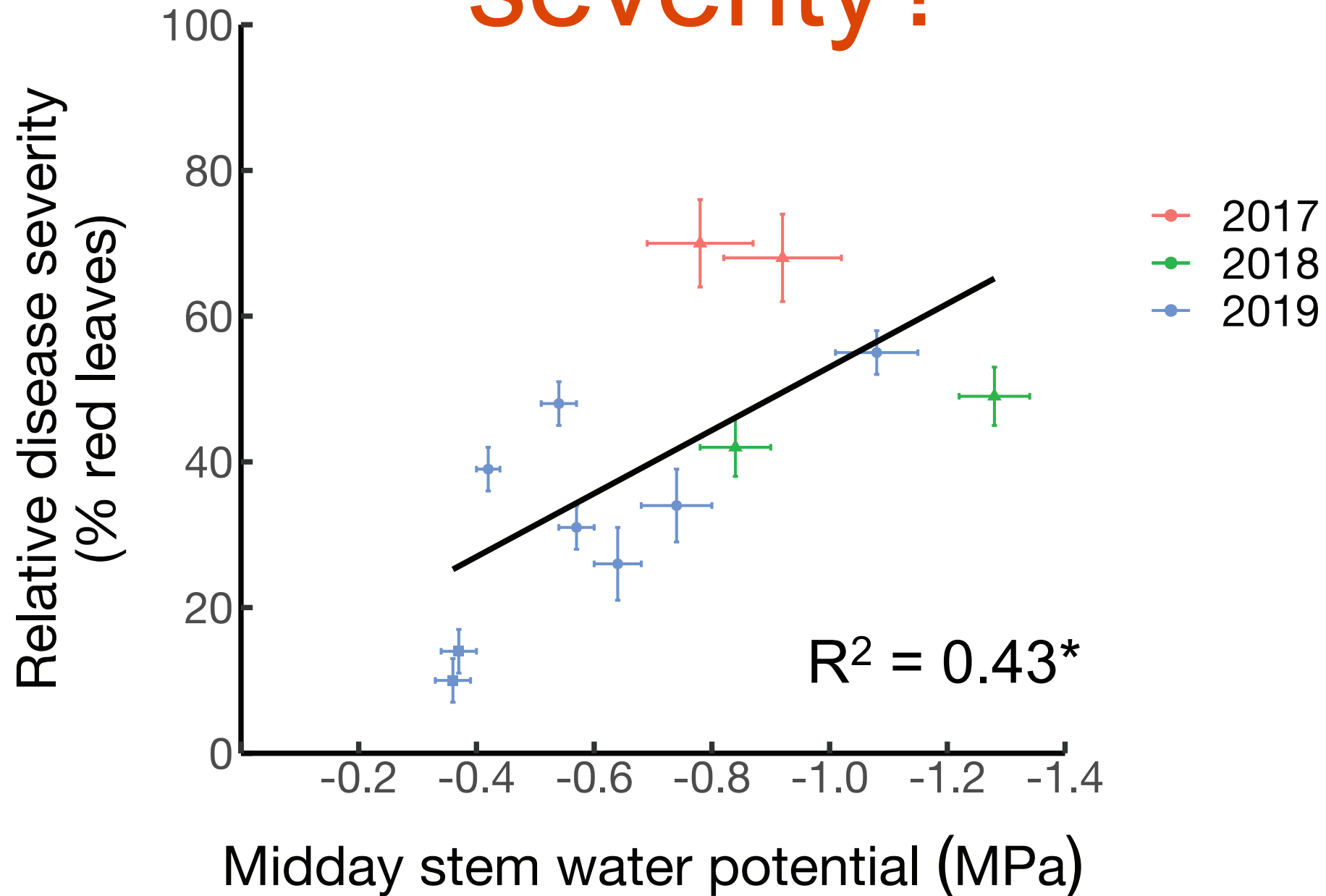
**Death?**

still many questions remain...





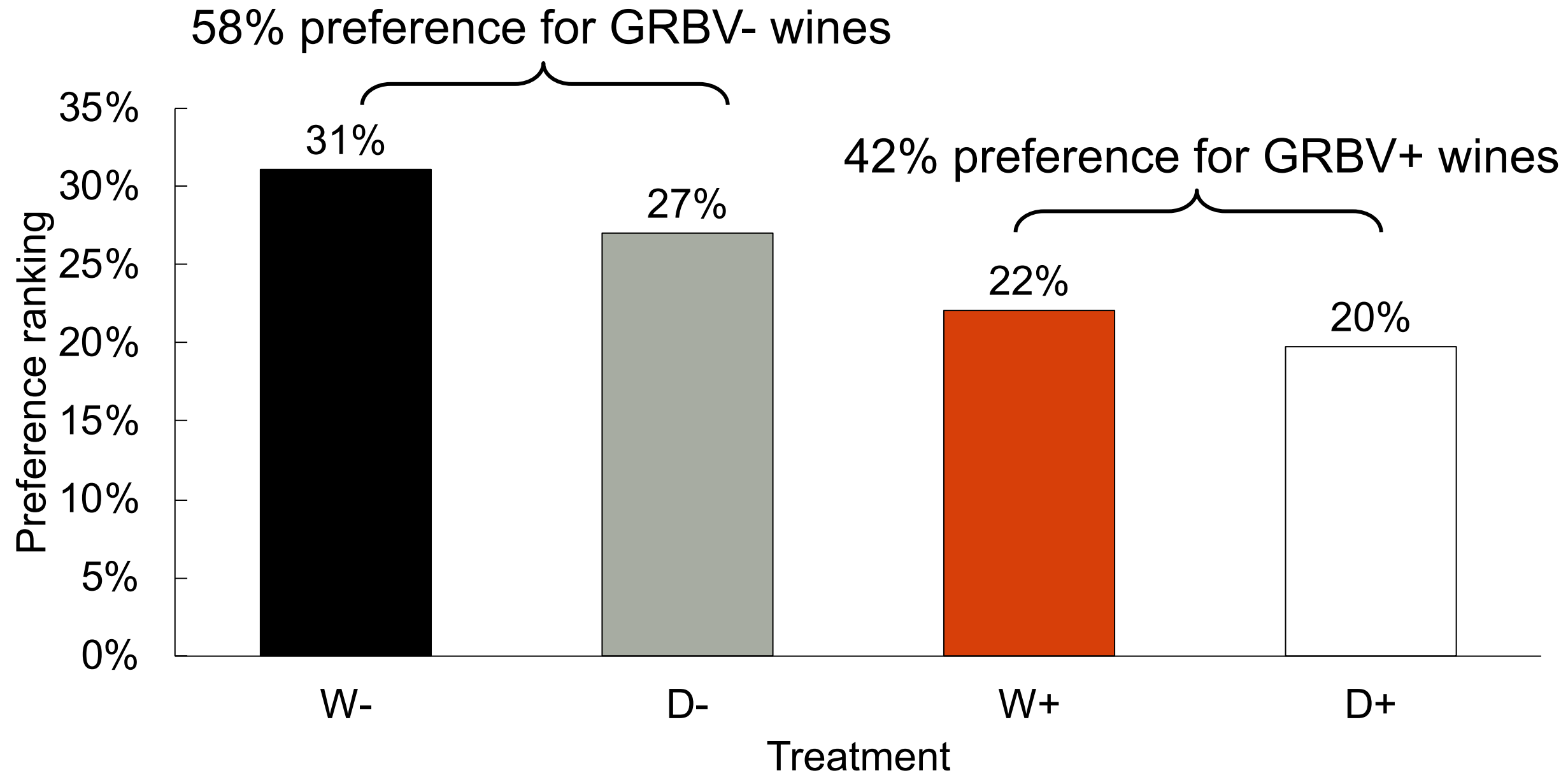
# Water stress increases disease severity?



# Role of the winemaker



# Quality is (of course) subjective



# Federal funding for GRBV research

- USDA-NIFA Specialty Crops Research Initiative
- \$3.2 million between UC and OSU
- Runs from 2019-2023
- Virology, entomology, viticulture, physiology, enology





# THANK YOU!

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**Oregon State University**

**Southern Oregon Research  
and Extension Center**

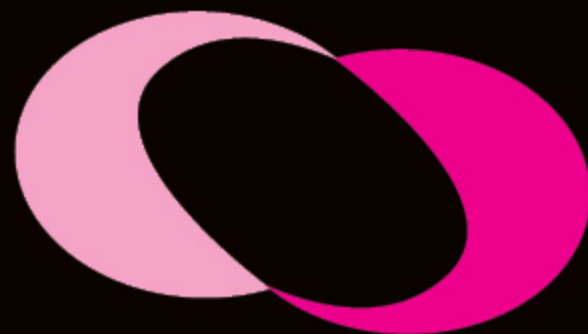




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# Innovation + Quality Award Winners



# Braud 9090X

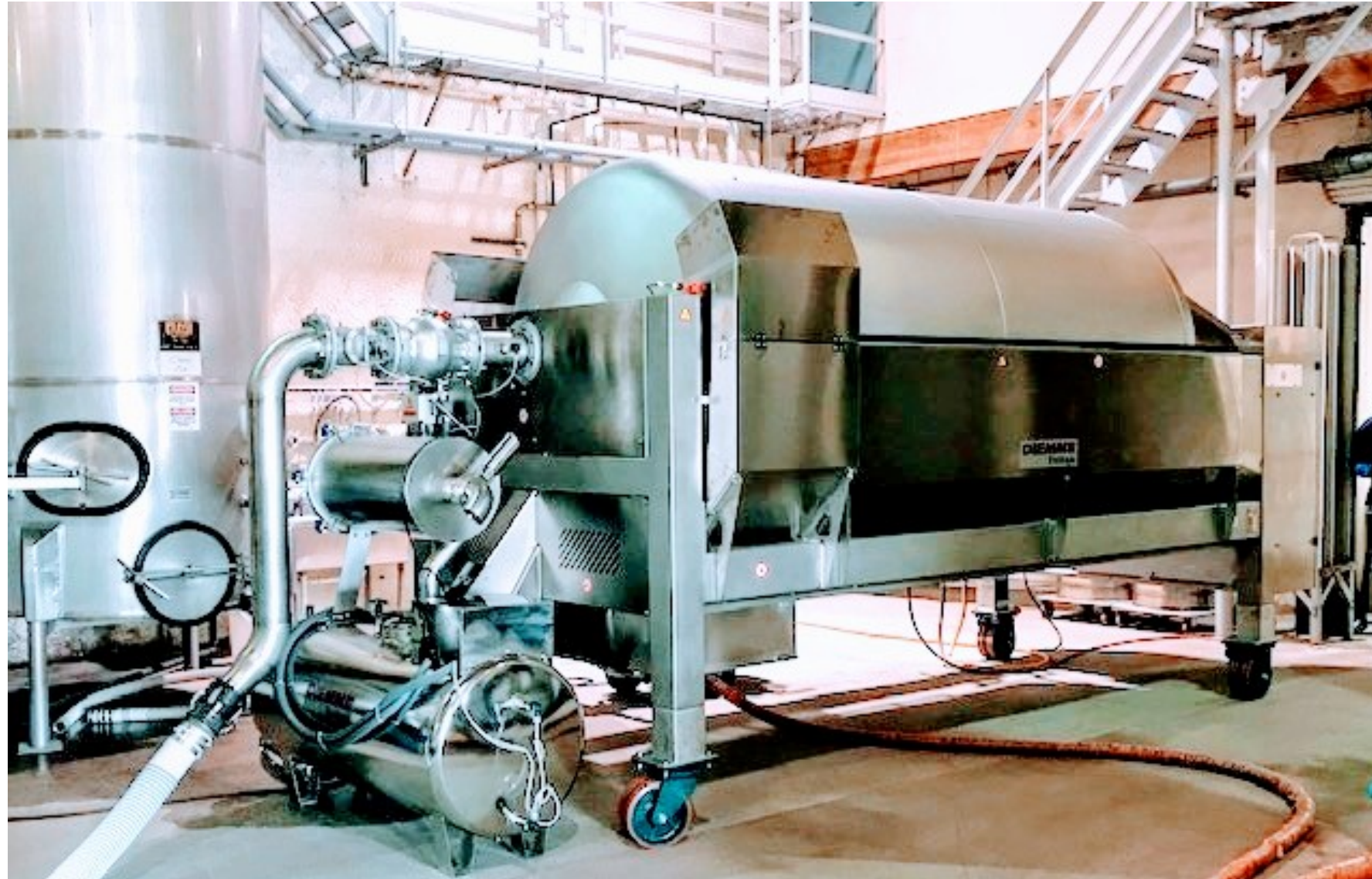
## New Holland Agricultural





# Diemme Neutral 2 System

## Diemme Enologia

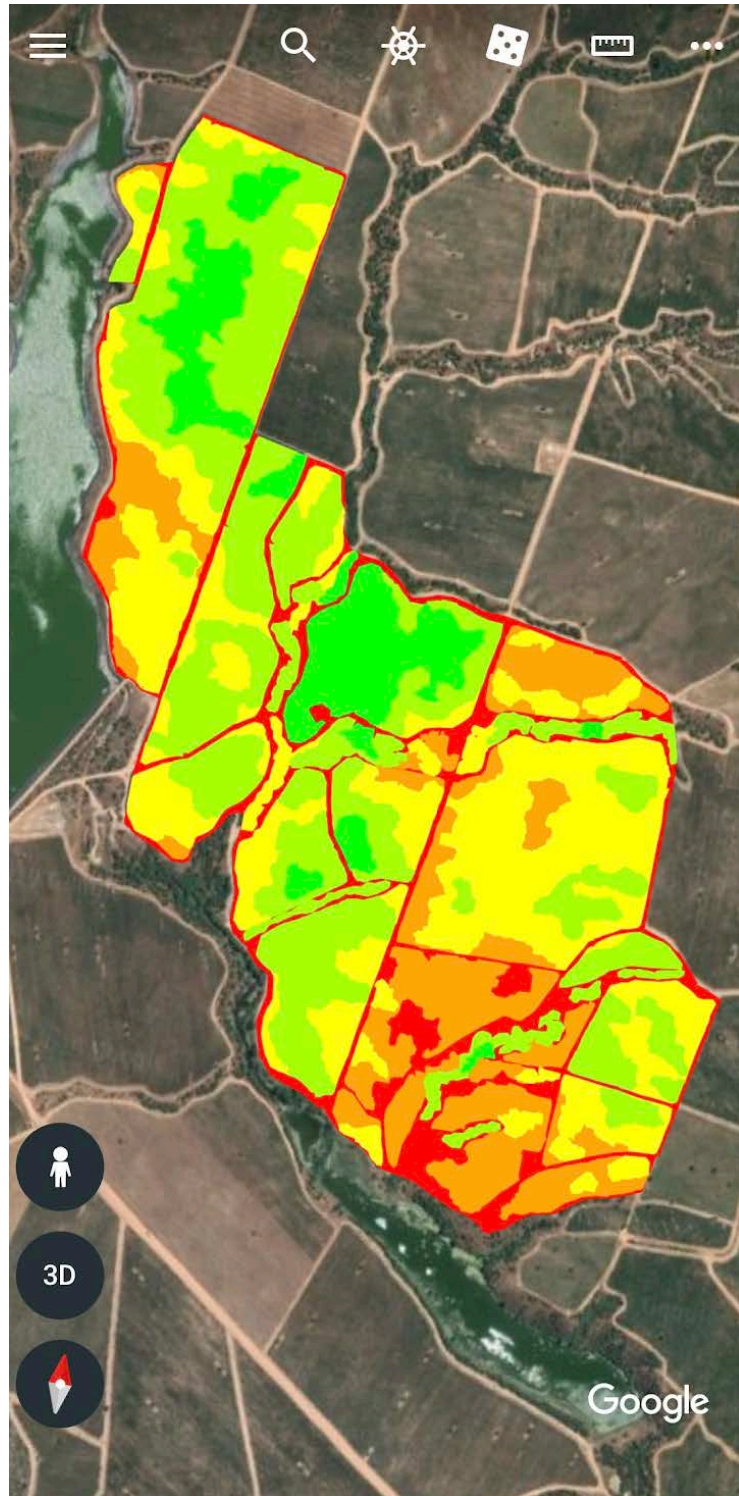


# Pera Automatic-Control Systems

## Pera Pellenc





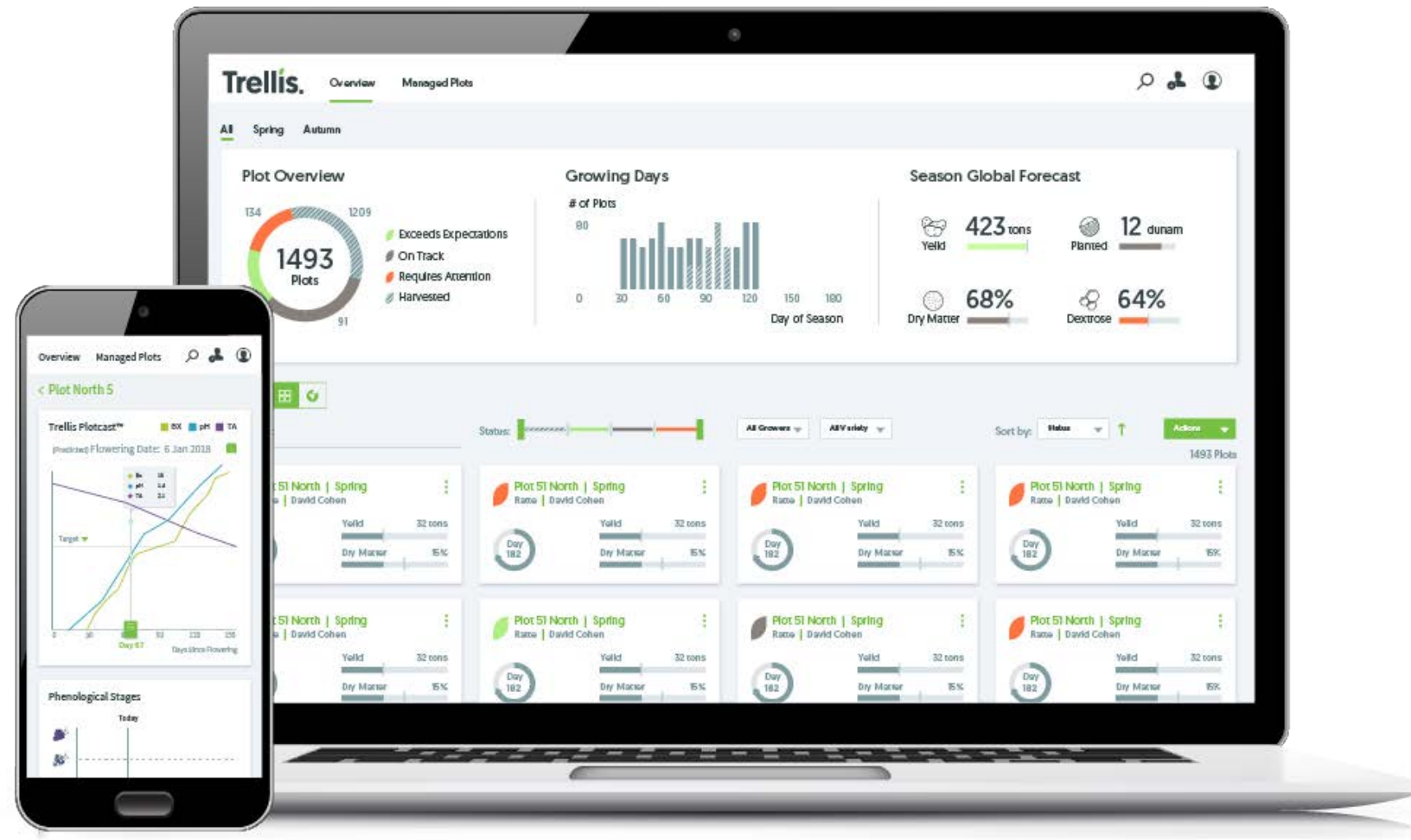


# Precision View Pollen Systems



# Trellis AI Crop Prediction

## Trellis







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# A Changing Landscape: Producing Premium Wine in a New Environment



**Miguel A. Torres**

president and managing partner,  
Familia Torres

Introduction **Miguel A. Torres**  
to keynote-tasting

**“A Changing Landscape: Producing premium Wine in a New Environment”**  
by **Marimar Torres** at

IQ Conference 2020 by Wine Business Monthly



**Marimar Torres**

founder and proprietor,  
Marimar Estate Vineyards



**Cristina Torres**

director of sales and marketing,  
Marimar Estate Vineyards



# Wines:

2017 Marimar Estate Albariño, Russian River Valley, Sonoma County

2016 Familia Torres Forcada, Penedés, Spaine

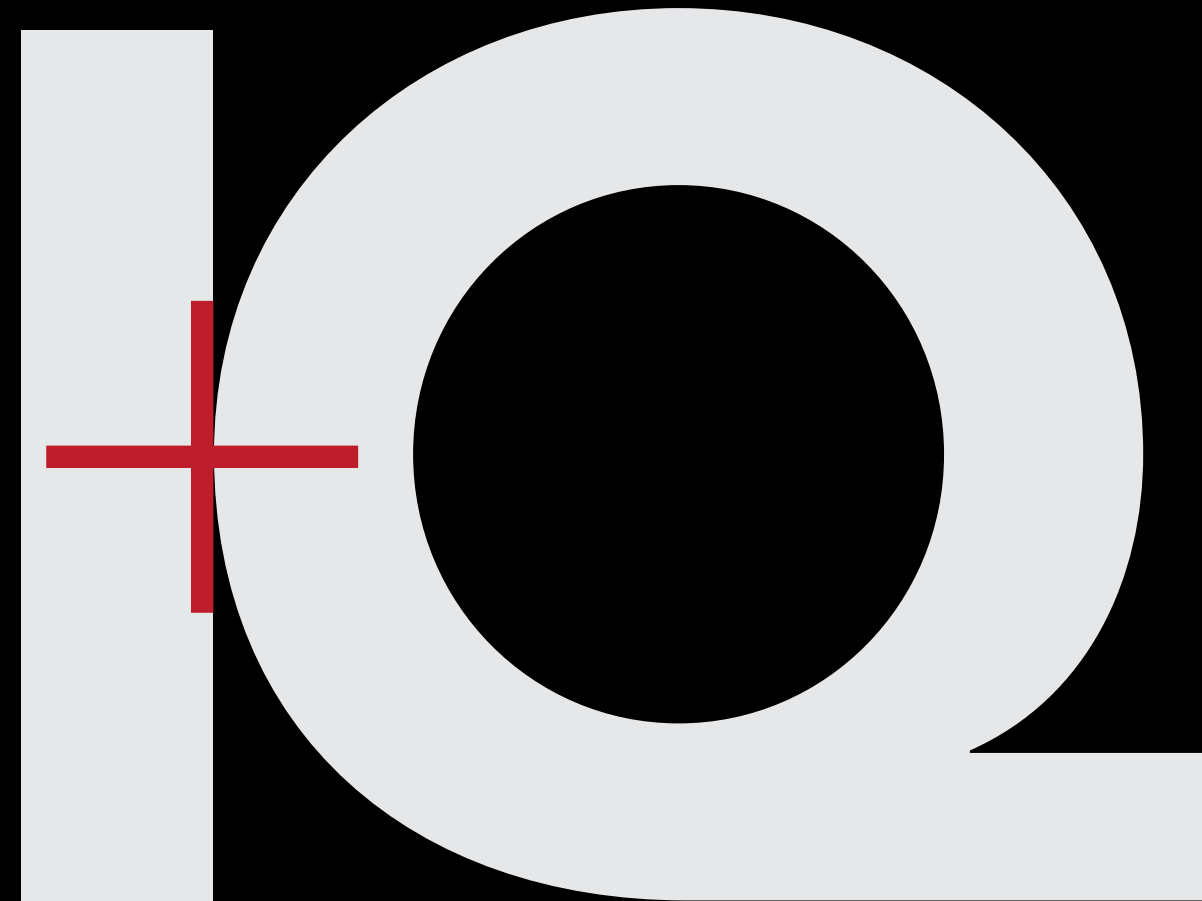
2014 Marimar Estate Cristina Pinot Noir, Russian River Valley, Sonoma County

2016 Familia Torres Purgatori, Costers de Segre, Spain

2012 Familia Torres Mas La Plana, Penedés, Spain

2009 Familia Torres Grans Muralles, Conca de Barberà, Spain





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IQ 2020 *Lifetime Innovator Award*

Roger Boulton



# Some Thoughts on Research

Roger Boulton

Innovation + Quality 2020  
CIA St. Helena, CA  
Thursday February 27<sup>th</sup> 2020



# Outline

- Enthusiasm and Imagination
- Limitations of Equipment
- Project Outcomes
- Research Funding
- Parting Thoughts
- Acknowledgements





# Enthusiasm and Imagination

“Nothing great was ever achieved without *enthusiasm*”

Ralph Waldo Emerson

“I would rather have questions that can't be answered *than answers that can't be questioned.*”

Richard Feynman

“*Imagination* is everything. It is the preview of life's coming attractions”

Albert Einstein



“*Destiny* is not a matter of chance, it is *a matter of choice*.  
It is not to be waited for, it is *a thing to be achieved*.”

Williams Jennings Bryan

“A long habit of not thinking a thing wrong *gives it the superficial appearance of being right*.”

Thomas Paine

“Even if you’re on the right track, you’ll be run over *if you just sit there*.”

Will Rogers



# Limitations of Equipment

“Nothing tends so much to the advancement of knowledge as the application of a new instrument.

The native intellectual powers of men in different times are not so much the causes of different success of their labours, as the peculiar nature of the means and ....resources in their possession.”

Sir Humphrey Davy



# Project Outcomes

- Experimental Results, Data, Findings
  - Publications
  - Intellectual Property
  - Intellectual Capital, the student
  - Systems and facilities for other Projects
- 
- Should be evaluated as insurance premiums not return on investment



# Research Outcomes

“It is folly to use as one’s guide in the selection of fundamental science, *the criterion of utility*.

Not because (scientists)...despise utility, but because....

...*useful outcomes are best identified* after the making of discoveries, rather than before.”

John C. Polanyi





# Research Funding

“I believe in *innovation* and that the way you get *innovation* is you *fund research* and you learn the basic facts.”

Bill Gates

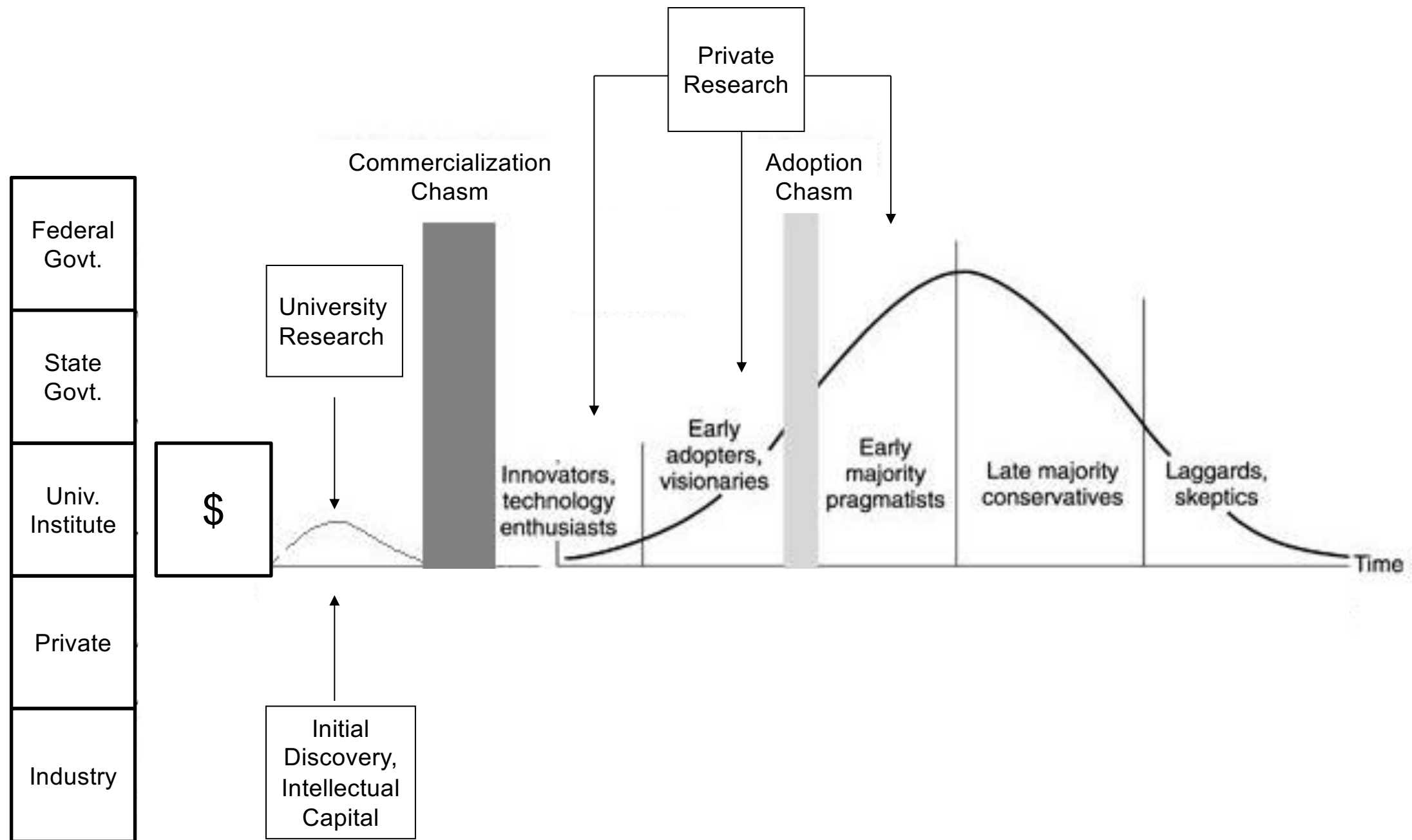
“*Starving research and development* is like eating the seed corn.”

Mitt Romney

“If you always do what you always did, *you will get what you always got.*”

Albert Einstein

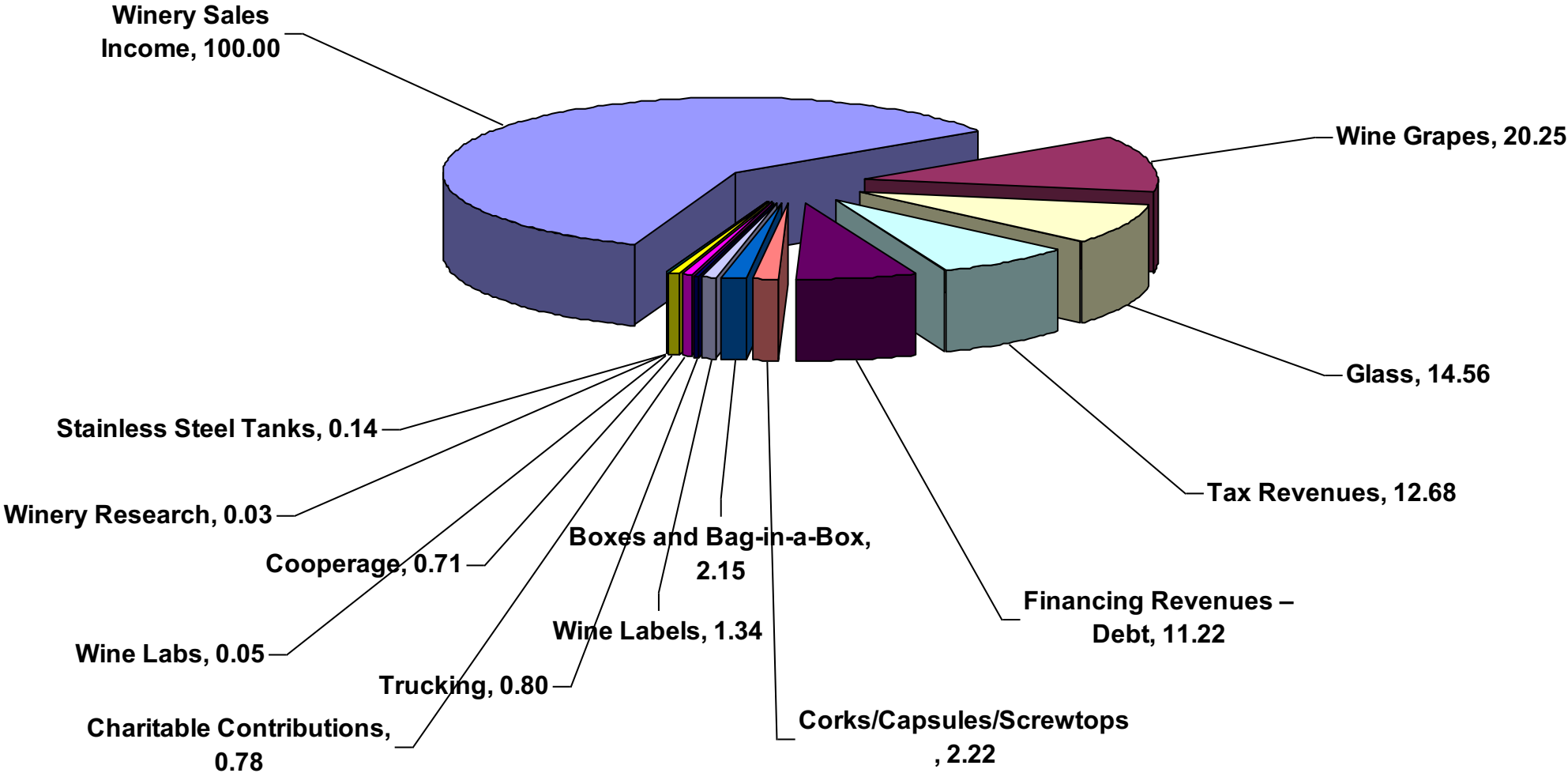




**The Funding of Research Discoveries and Outcomes**



**Californian Winery Expenditures as Per Cent of Sales**  
**[1999 Data, Wine Institute Web Site]**



# Parting Thoughts:

“Much learning does not teach understanding.”

Heraclitus

“Whatever you do will be insignificant, but it is very important that you do it.

Mahatma Gandhi



# Acknowledgements

Innovation + Quality 2020 - Board and Awards Committee

Teachers and Coaches in Australia and the US

Emeriti, Colleagues, Staff and Students at UC Davis

Colleagues and Winemakers throughout the global Wine Community

The Stephen Sinclair Scott Endowment

My Family and Friends





# Salons @



## **1:00 pm - The Closure Conundrum: Which closure is best for your wine?**

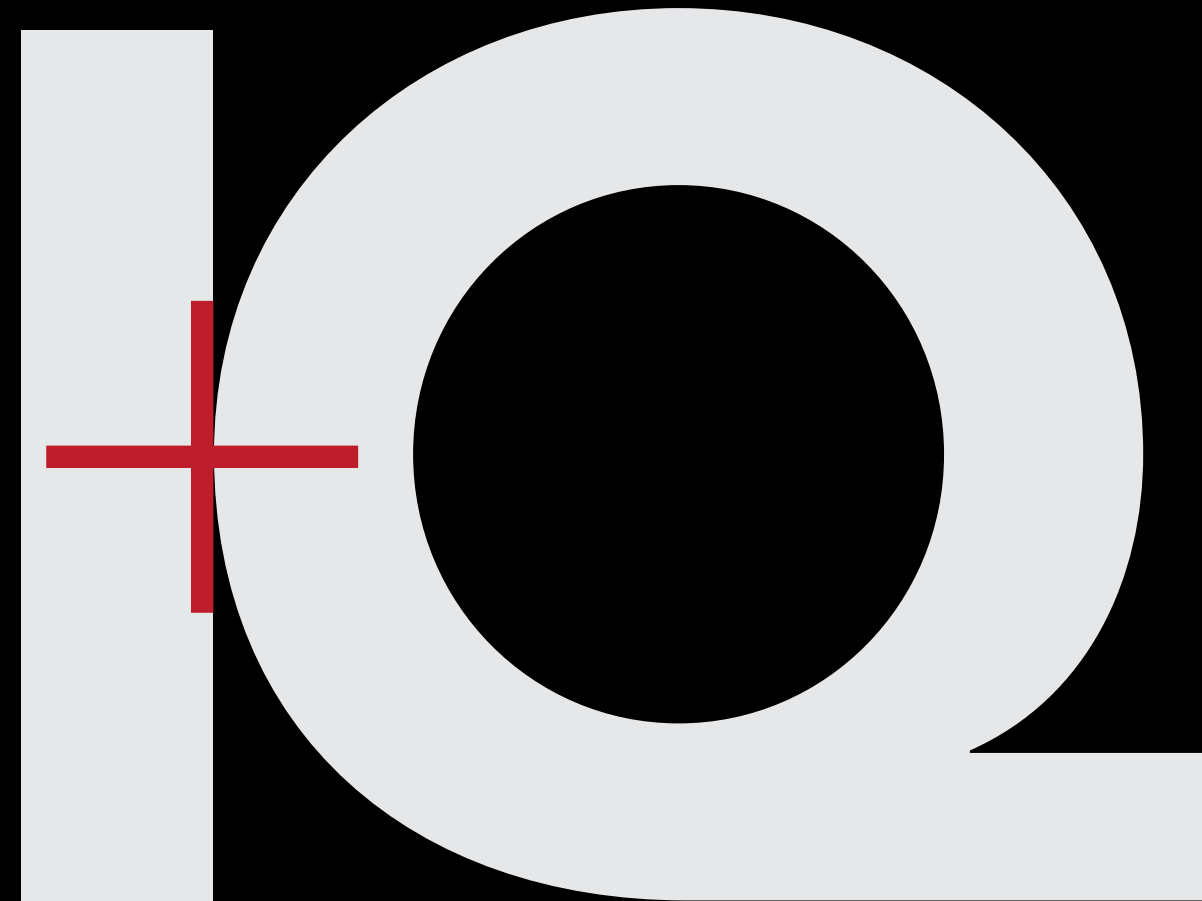
Douglas Fletcher, Jordan Wente, Jim Gordon

## **2:00pm - Can Mechanization Deliver Higher Quality?**

Cyril Penn, Aaron Fishleder, S. Kaan Kurtural, Matthew R. Heil

## **3:00 pm - Wine's Big Generational Shift: How the up-and-comers are shaping the future of wine.**

Nova Cadamatre MW, Simon Faury, Justin Leigon, Erin Kirschenmann, Chris Puppione



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