Is extra irrigation during heatwaves necessary?

Charles Obiero

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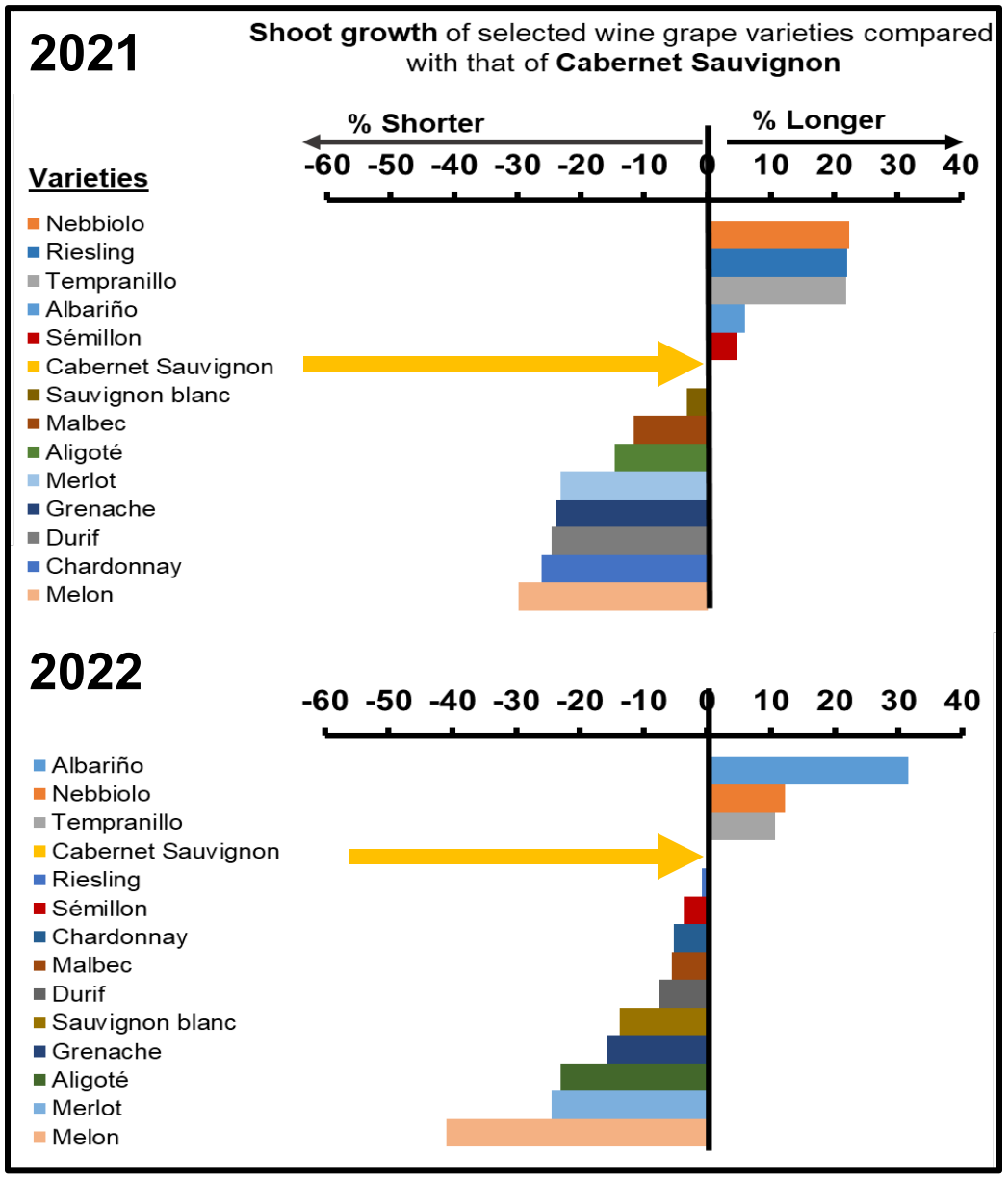
Viticulture and Enology

How much do you know about your vines?

- About vine’s canopy size and how it may alter irrigation scheduling
- Whether vines “feel thirsty” at same soil moisture thresholds

Tasty wine, different canopy size!

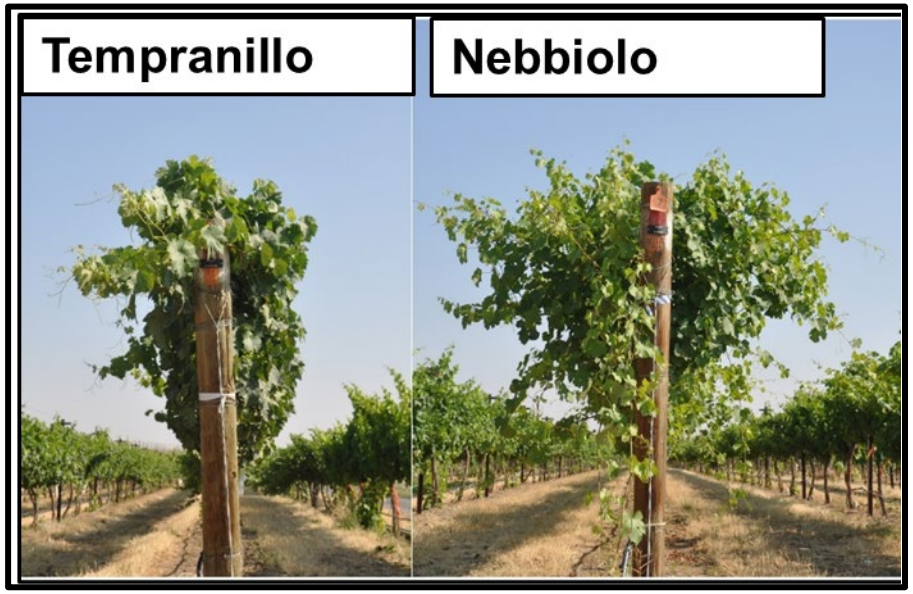


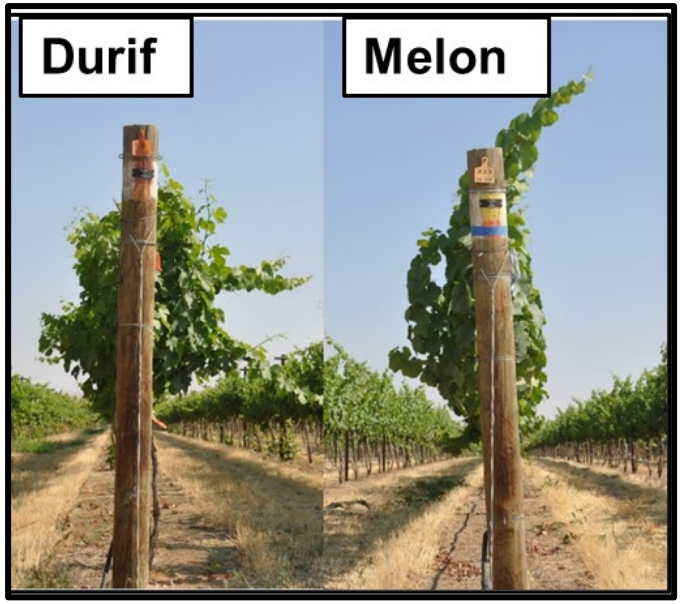
More vigorous	Less vigorous
• Nebbiolo • Tempranillo • Albariño	• Durif • Aligoté • Melon

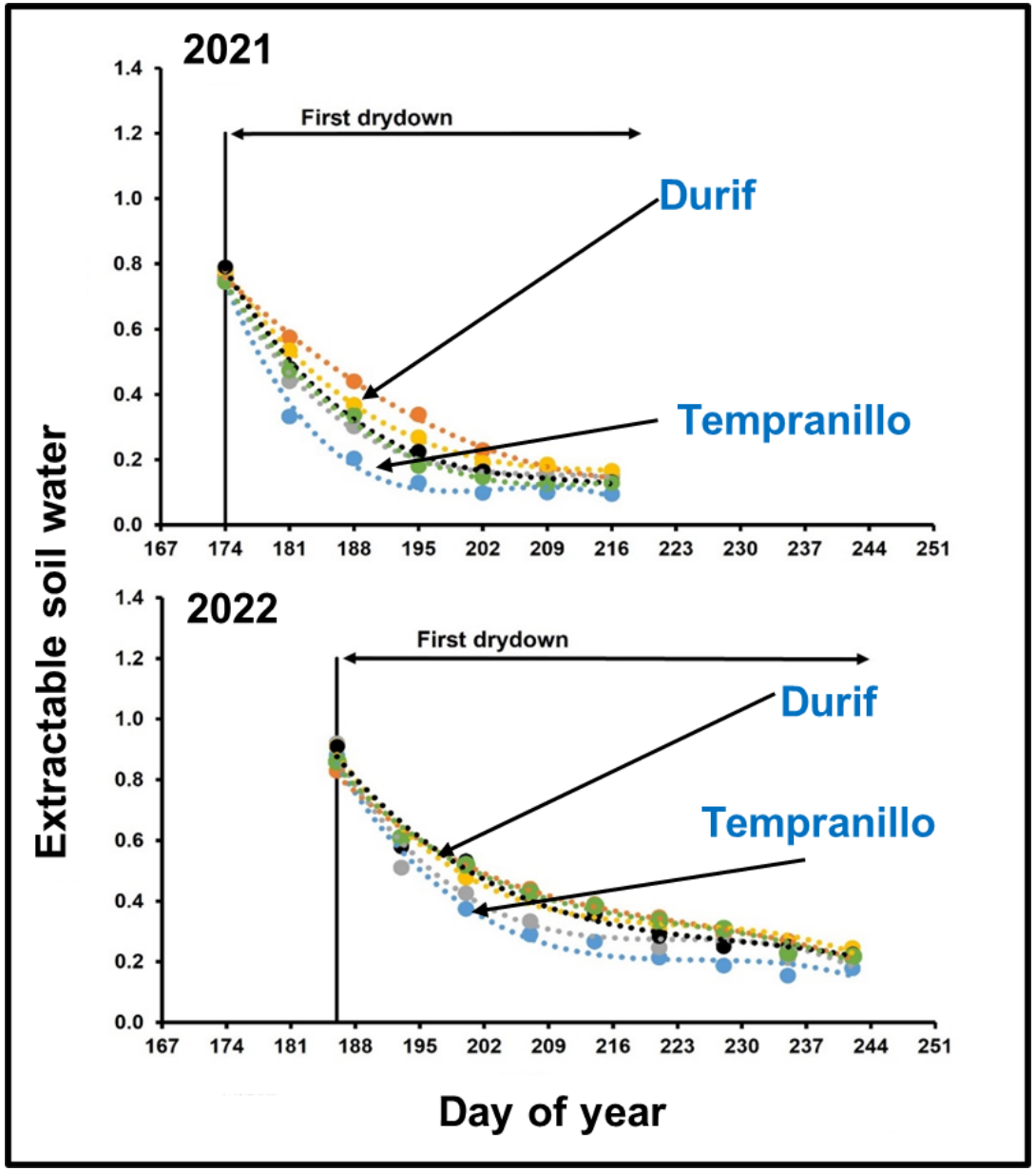
Compared with Cabernet Sauvignon

- Bigger canopies = **10 to 30%** longer shoots
- Smaller canopies = **10 to 40%** shorter shoots

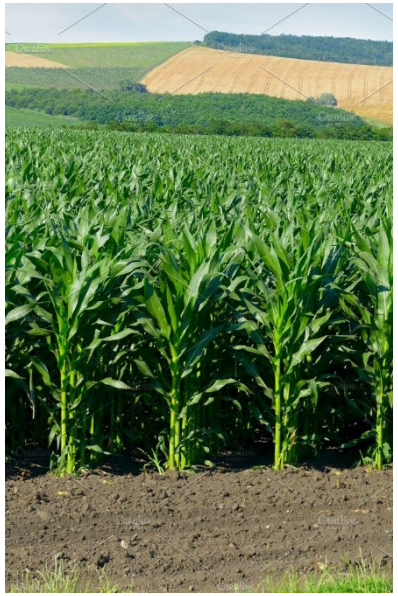
Bigger canopy ONLY means more water

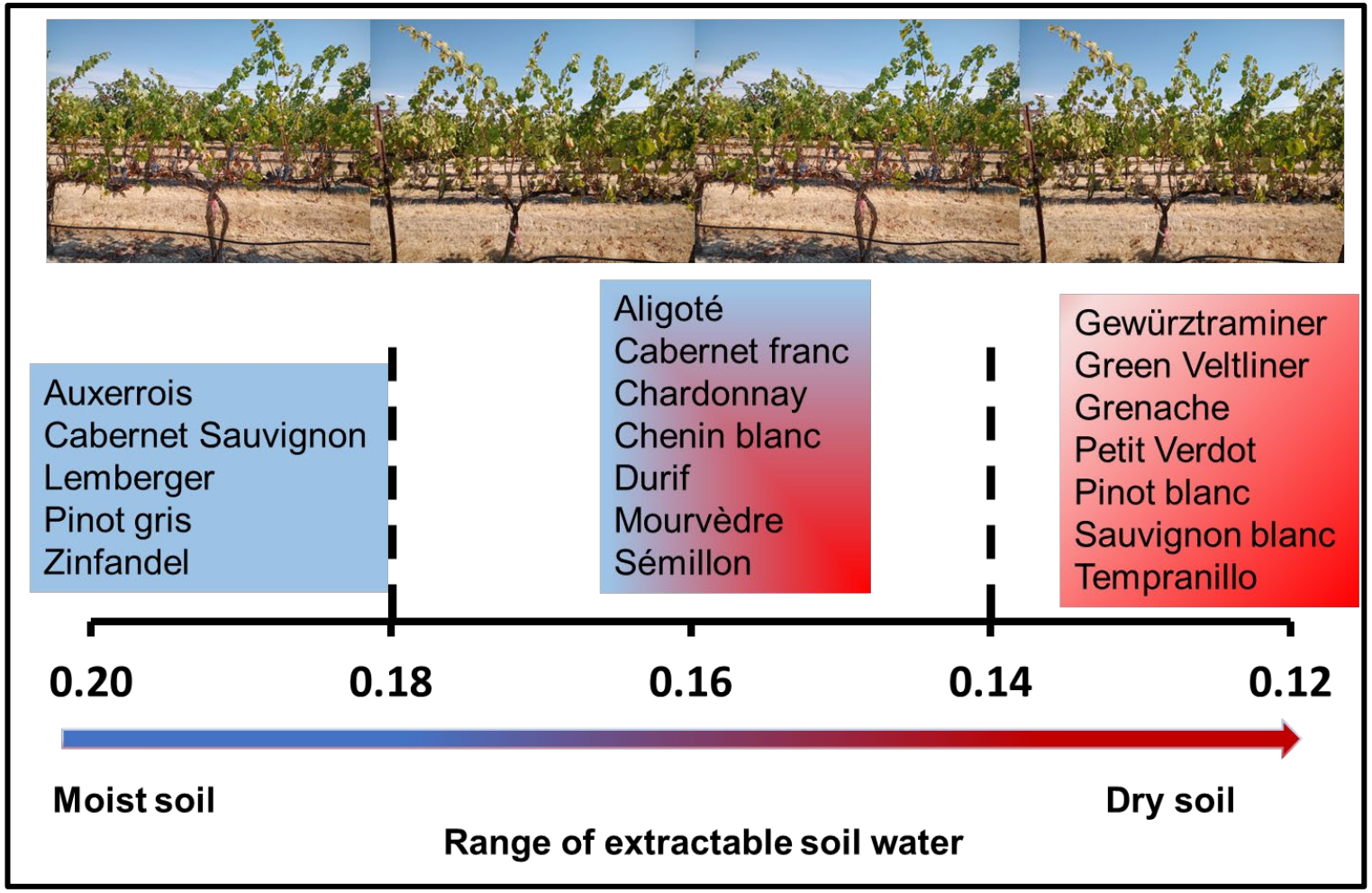






Different thresholds at which vines “feel thirsty”





What it all means… "*too much is not always better*"

1. Irrigation based on canopy size

- Vines with bigger canopy may need extra water especially during heatwaves

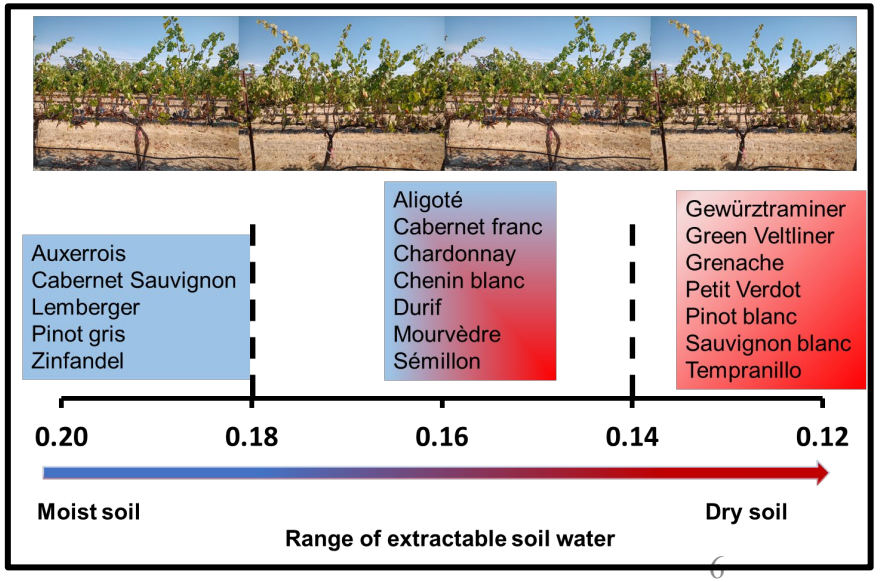
2. Irrigation based on Extractable Soil Water (ESW)

$$\textbf{ESW} = \frac{\text{Volumetric soil water} - \textbf{Permanent Wilting Point}}{\textbf{Field Capacity} - \text{Permanent Wilting Point}}$$

$$\text{Volumetric water content}\ (\%) = \text{Mass of water} \times \textbf{Bulk Density} \times 100\%$$

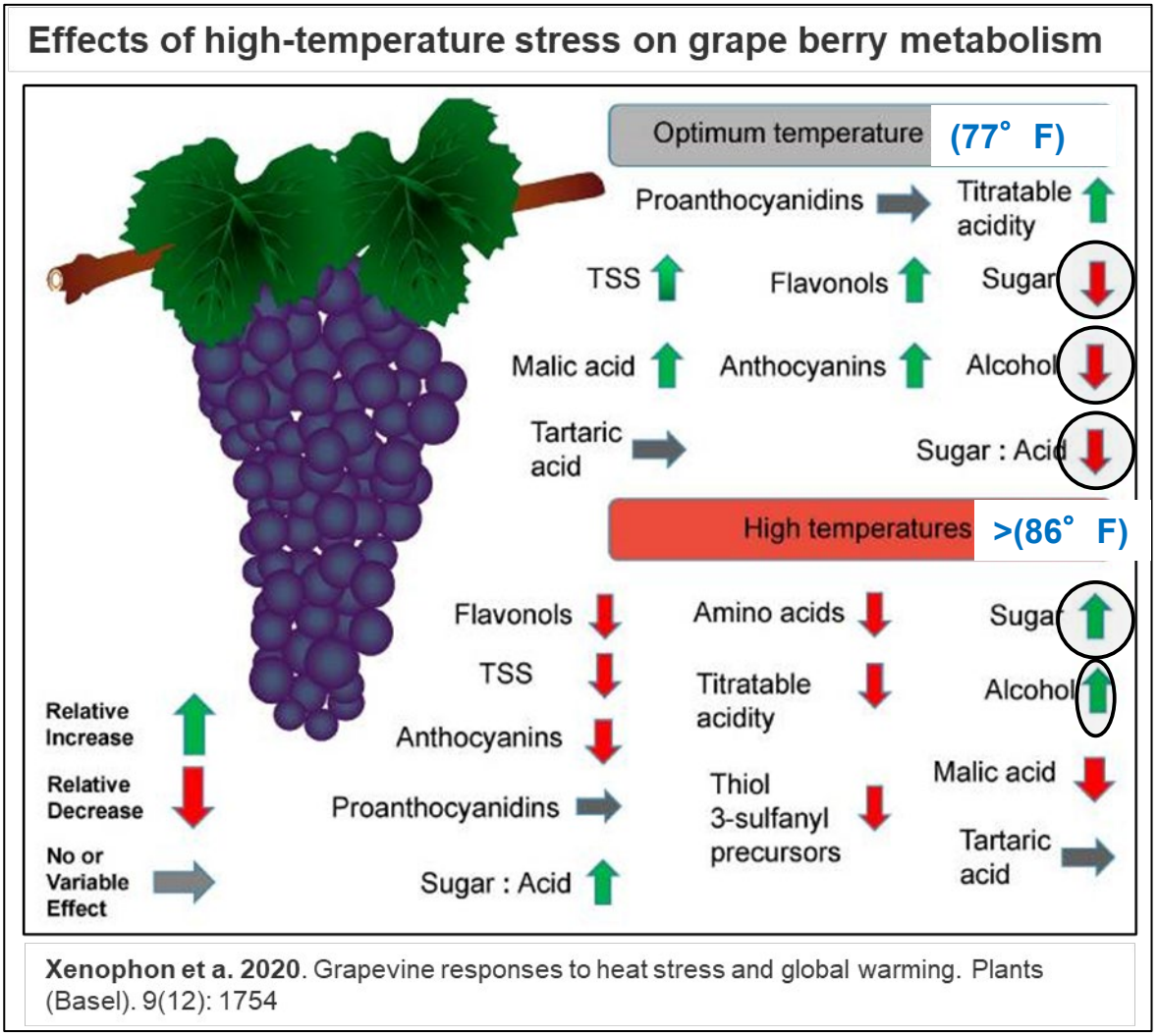
The catch!

Know your FC, PWP and Soil bulk density!



Is extra irrigation during heatwaves necessary?

Why we panic during heatwaves…..



Xenophon et a. 2020. Grapevine responses to heat stress and global warming. Plants (Basel). 9(12): 1754

*"If grapes develop too rapidly, there will be too **much sugar** at harvest and **too much alcohol** in the wine. Acidity also decreases with too much heat, making the **wine taste bland**", Markus Keller*

Extra irrigation during heatwaves amid the normal irrigation scheduling is a common industry practice

But considering water economy and sustainability is the practice necessary?

Our field trial

- A field trial conducted in **2022** and **2023** in a drip-irrigated research vineyard planted in 2010 at WSU Prosser

- **2 varieties** (own-rooted) fully irrigate through bloom: **Cabernet Sauvignon** and **Riesling**

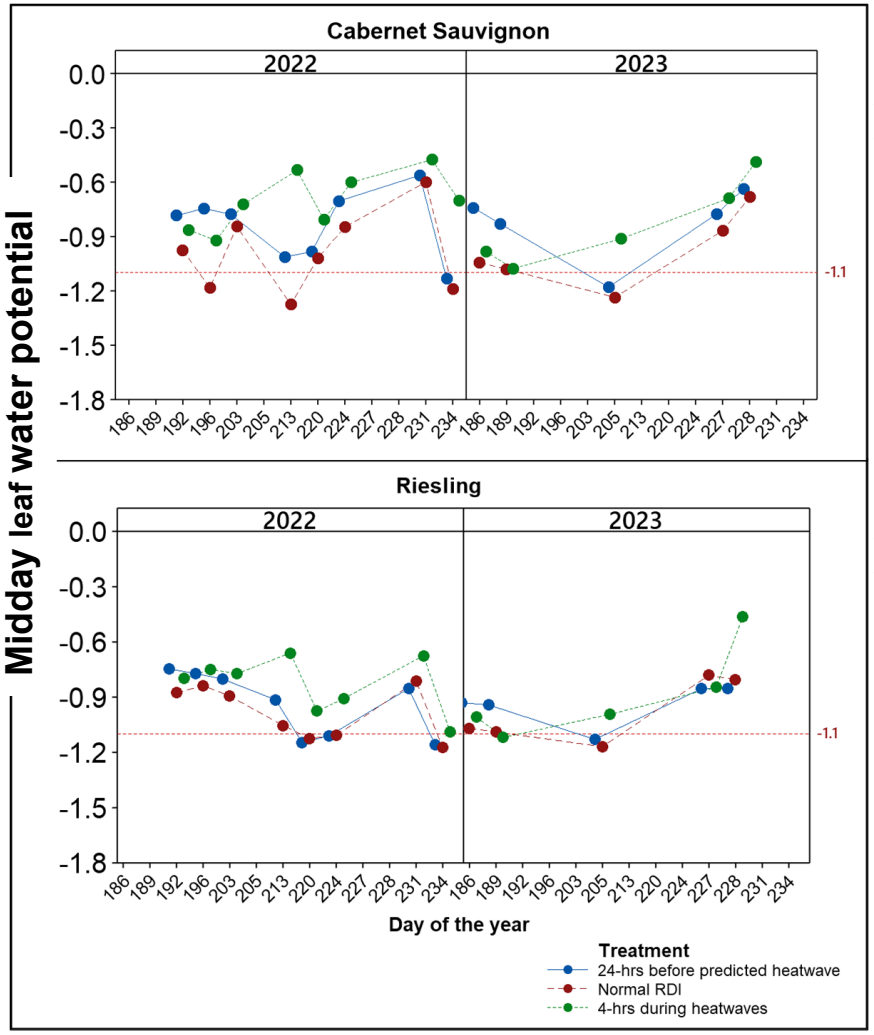
- **Irrigation during heatwaves:**
  - Standard Regulated Deficit Irrigation (**Normal RDI**)
  - **24-hrs before** forecasted heatwaves
  - **4-hrs during** heatwaves

- **Data collected:**
  - Midday Ψleaf (**pressure chamber**)
  - Gas exchange (**infra-red gas exchange system**)
  - Yield and yield components
  - Fruit composition (TSS, pH and TA)

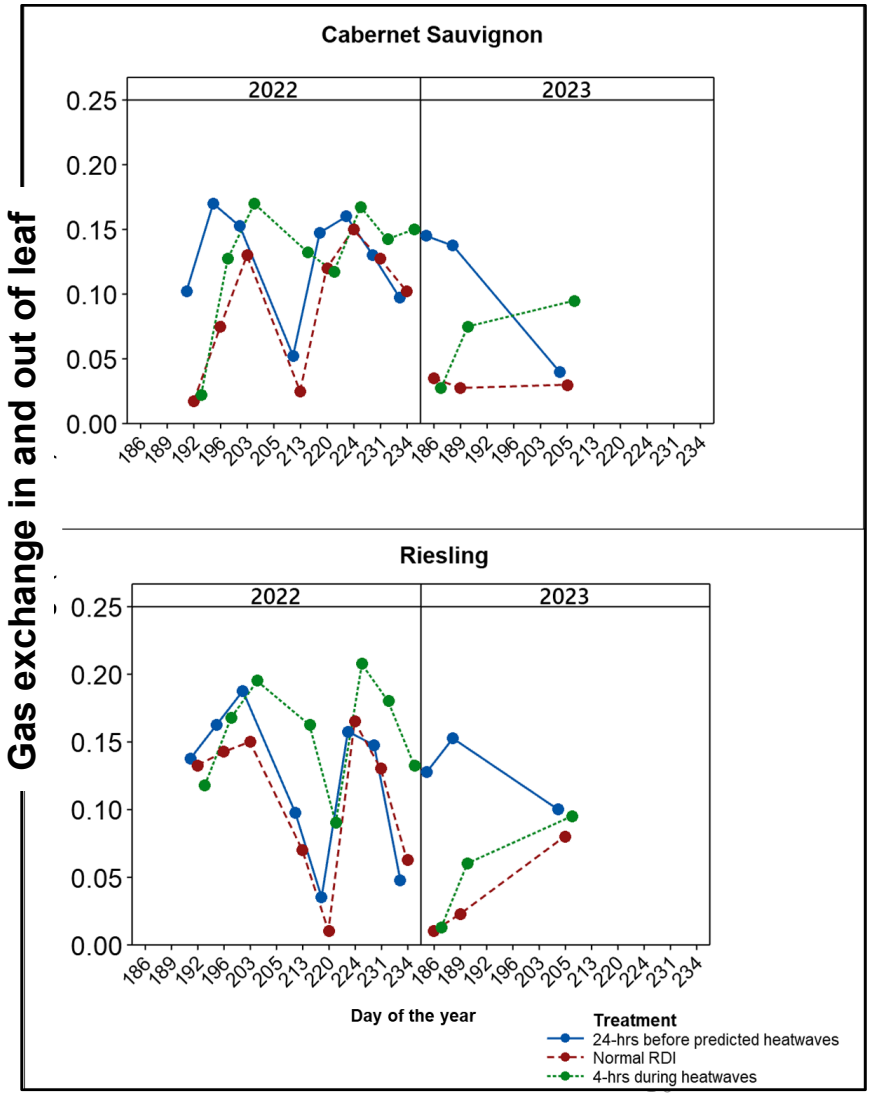
Pressure chamber

Infra-red gas exchange system

4-hrs of extra irrigation cooled vines better



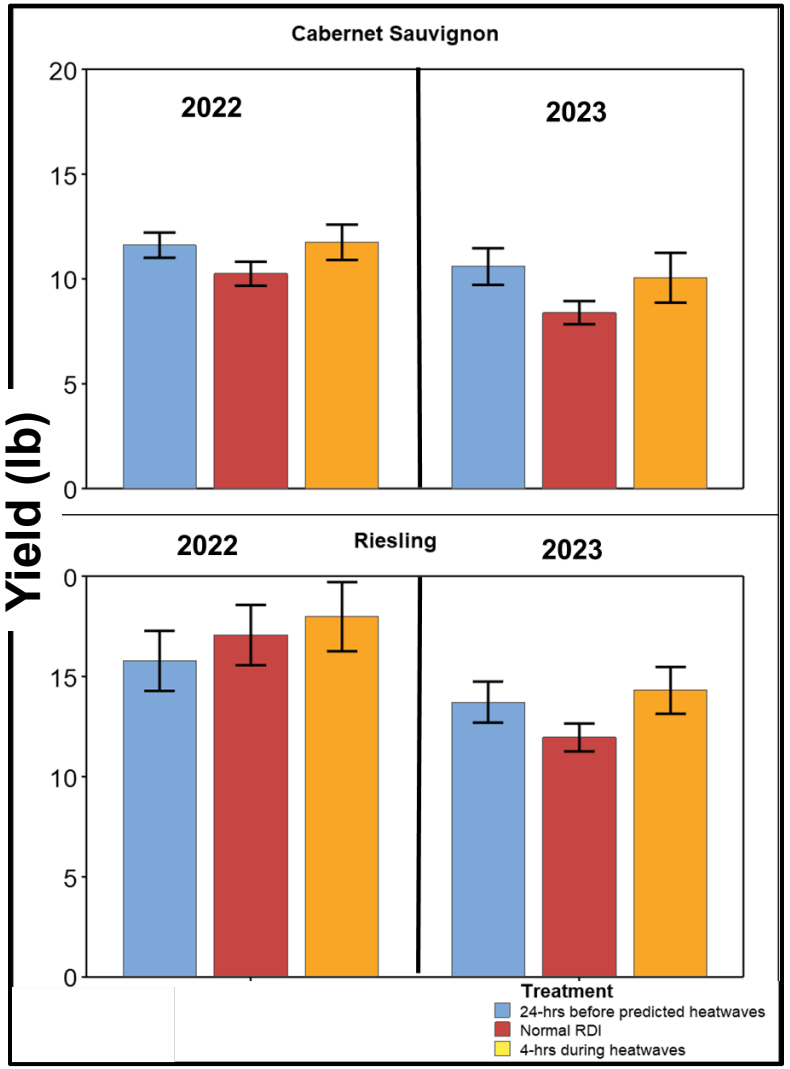
- 4-hrs of extra irrigation **increased Ψleaf** by **37-56%** compared to unirrigated RDI vines (**left graph**).
- At times, vines under extra irrigation had between **50 to100 times** more **gs** compared to RDI vines (**right graph**)



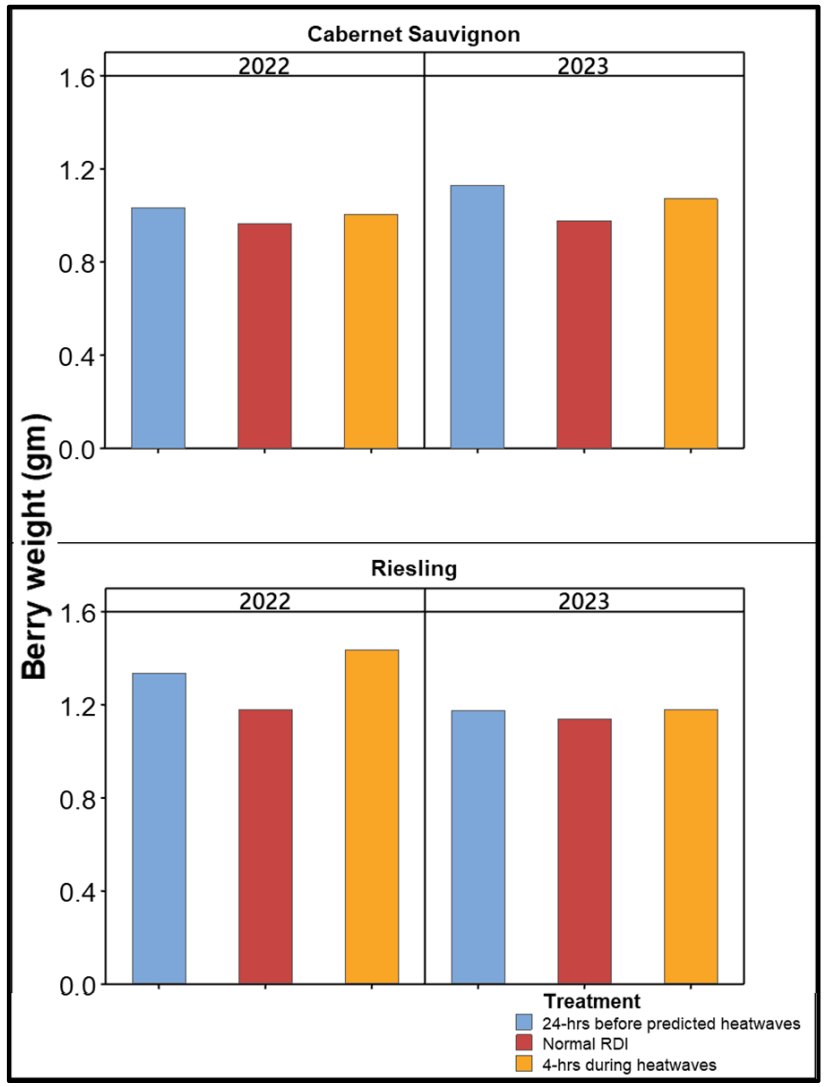
Extra irrigation increased 2nd year crop

- No significant differences in the 1st year (2022) yield

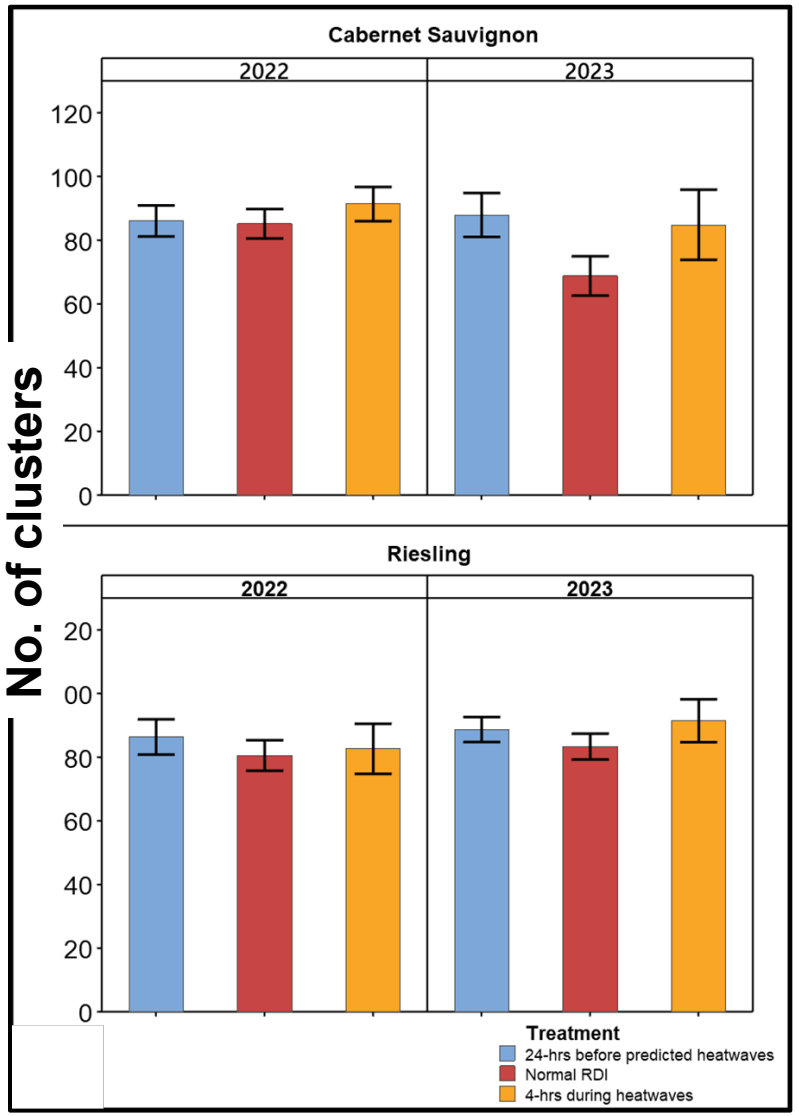
- But 2nd year (2023) showed **17 - 20%** yield increase in both varieties



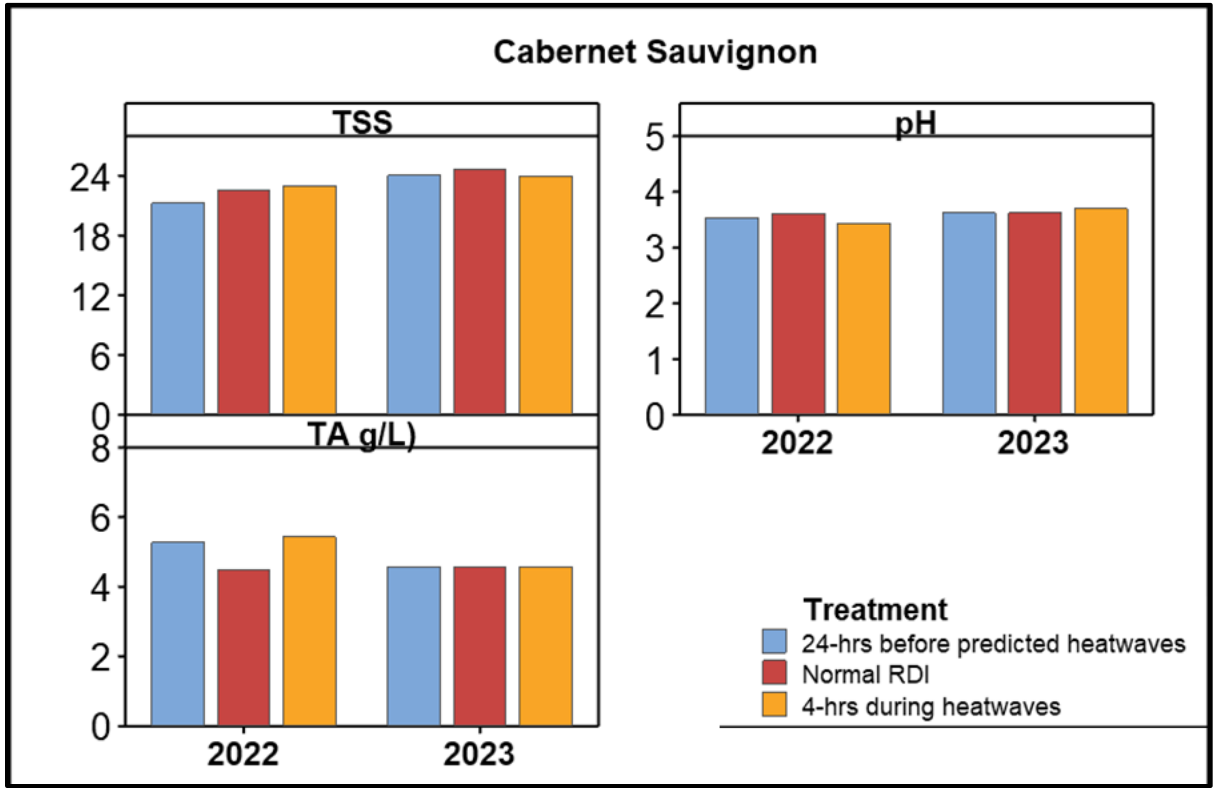
Increase in yield was probably due to more clusters

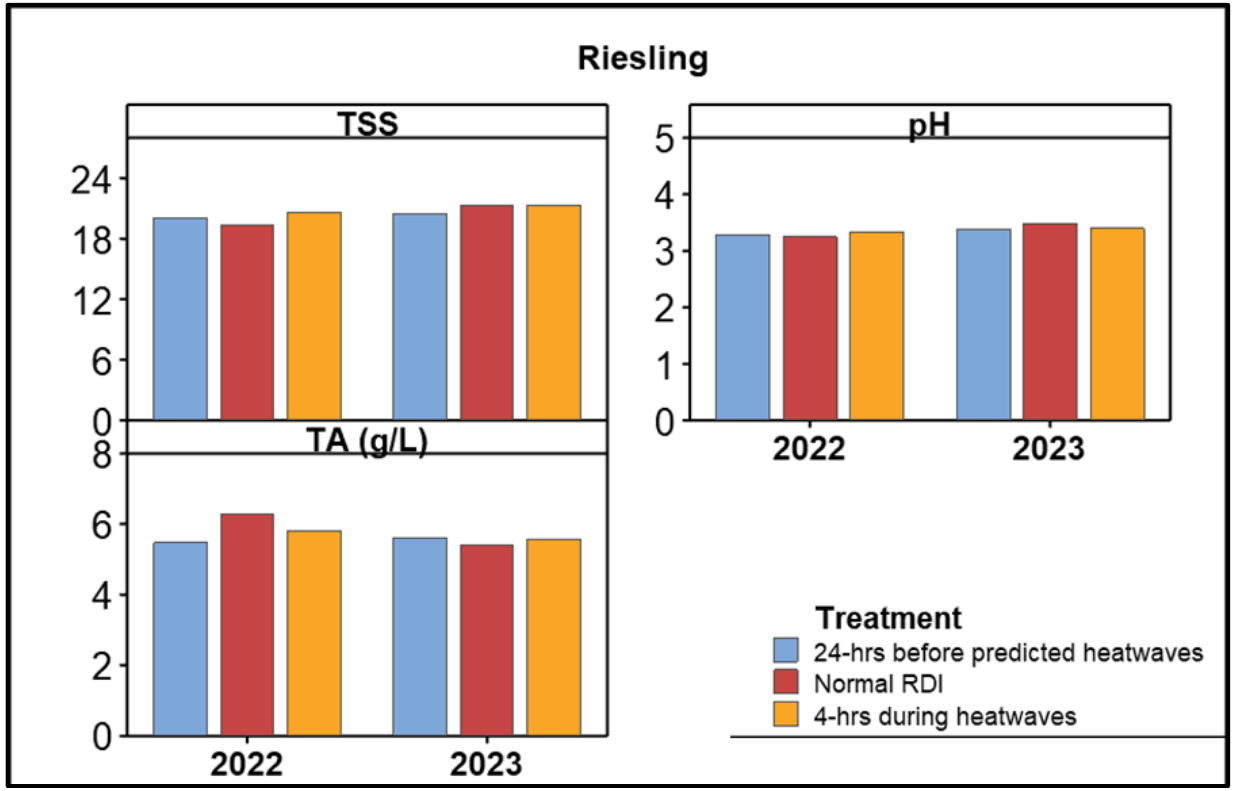


- **No significant** change in berry weight (**left graph**)
- ~10% (**Riesling**) to 16% (**Cabernet Sauvignon**) more clusters in 2nd year with extra irrigation (**right graph**)

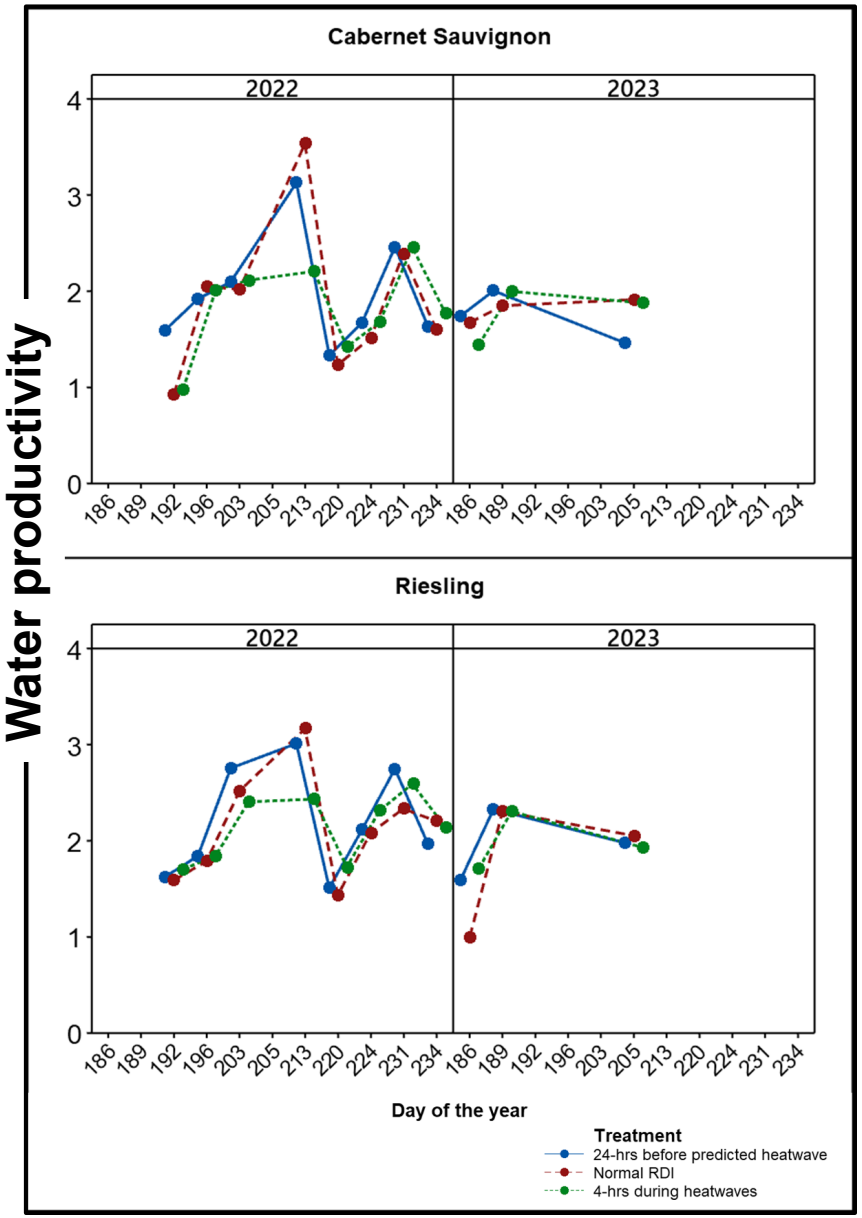


But no improvement in fruit composition





Is extra irrigation during heatwaves worth it?



➢ **Although there was ~ 17- 20% yield increase;**

- This was mostly from more clusters (vine's productivity?)
- No improvement on berry weight
- No improvement on fruit composition

➢ **More water used at less additional yield gain! (left graph)**

- Consider vine spacing: 9x6 ft ~ 807 vines/acre
- Emitters, say ½ gln/hr.

➢ **Meaning:**

- **24-hrs** = (24-hrs x ½ gln/hr x 807 vines/Acre) = **9684** gln/Acre

- **4-hrs** =(4-hrs x ½ gln/hr x 807 vines/Acre) = **1614** gln/Acre

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Thank you