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# **Irrigation for Wine and Juice Grapes: Differences and Similarities**

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A winemaker's dream...



...or a juice grape grower's nightmare?

# Water use: Wine vs. juice grapes

- Eastern WA: 5 – 10” (0.4 – 0.8 acre-ft) from rainfall per year
- Temperature and canopy size drive water use
- Irrigation water demand is highest from fruit set to veraison:

Water use	Grape type	
	Juice	Wine
Annual (mm)	600 – 750	300 – 500
Annual (inches)	25 – 30	7 – 16
Annual (acre-feet)	2 – 2.5	0.6 – 1.3
Budbreak – fruit set (%)	10	10
Fruit set – veraison (%)	50 – 60	30 – 60
Veraison – harvest (%)	20	10 – 30
Harvest – leaf fall (%)	15 – 25	10 – 25

(Refill top 3 ft of soil for freeze and start-up insurance.)

# Juice grapes: Irrigation for crop size

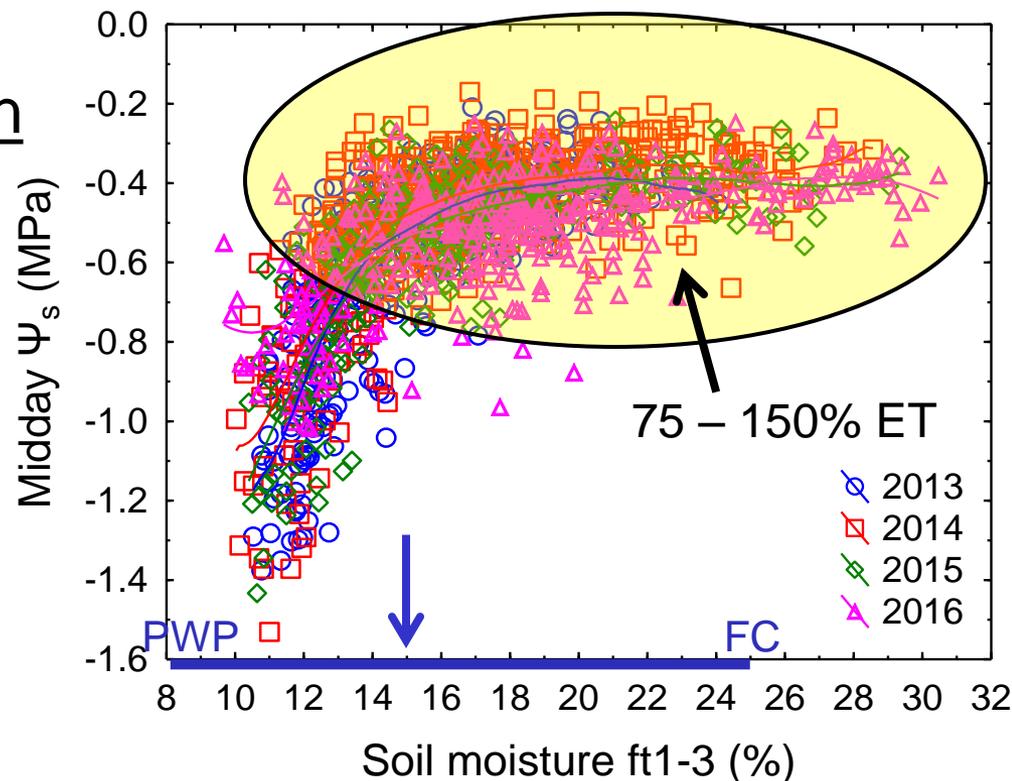
- Concord irrigation trial in WSU-IAREC vineyard
  - 7 irrigation regimes (50% ET – 150% ET), 2011 – 2016
- Soil moisture threshold:  $<15\%$  v/v  $\rightarrow \Psi_s$  declines
  - $\Psi_s$  = Stem water potential = Measure of plant water status
  - Vines do not feel water-stressed above threshold
  - More irrigation = Waste of water

## • 50% ET irrigation preveraison

- 31% less water than 100% ET
- 15% smaller canopy
- 10% fewer clusters
- 8% smaller berries
- 14% lower yield  
(6-year avg.: 15.7 vs. 18.2 t/a)

## • 75 – 150% ET irrigation

- No consistent differences

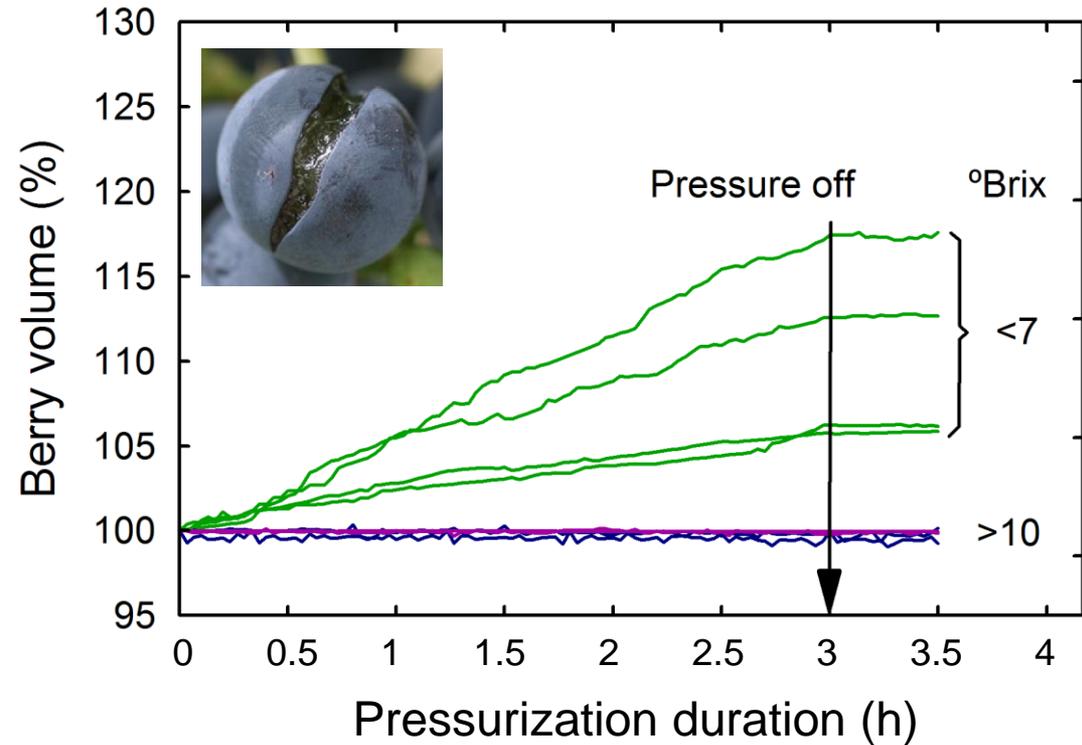
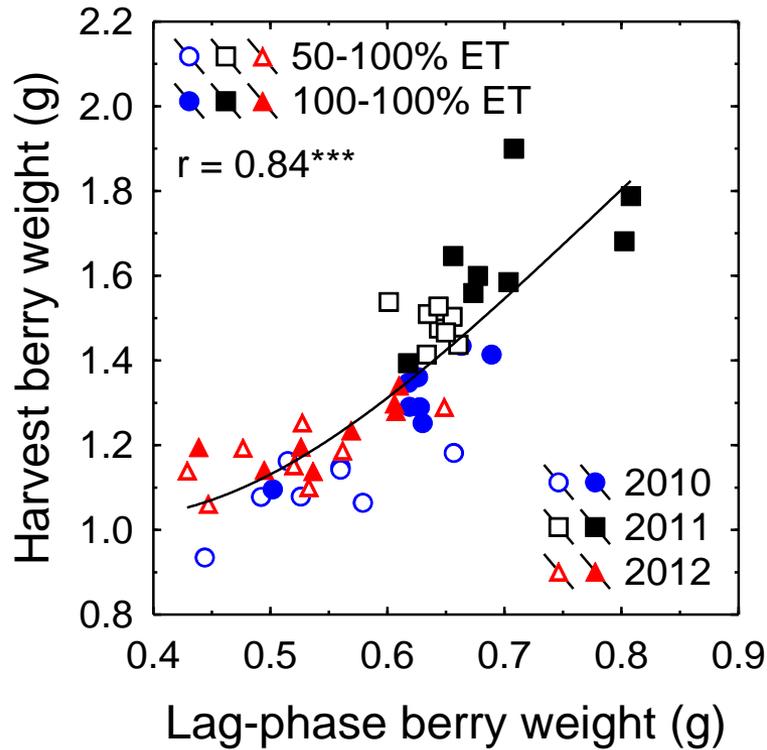


# Juice grape irrigation: Lessons learned

- **Preveraison irrigation:** Less water → Smaller berries
  - Yield is 14% lower with 31% less water at 50% ET, but not at 75% ET
  - No gain in yield with 150% ET despite 32% more water
- **Postveraison irrigation:** No effect on berry size and yield
- Berry size is determined before veraison
- Compensation during ripening for preveraison water shortage is not possible
- Seasonal variation and pruning trump irrigation:
  - Yield varied only 15% among irrigation regimes, but more than 3-fold among 6 years (due to 2-fold, independent variation in clusters/vine and berries/cluster, but only 10% in berry weight)
  - Temperature, and less so crop load, determine Concord fruit composition, but irrigation has little effect

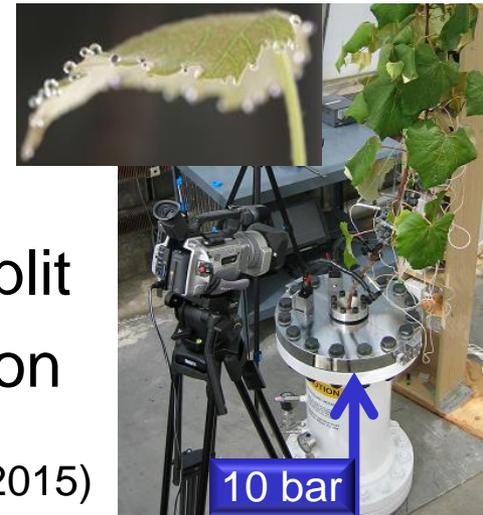


# Wine grapes: Irrigation for berry size

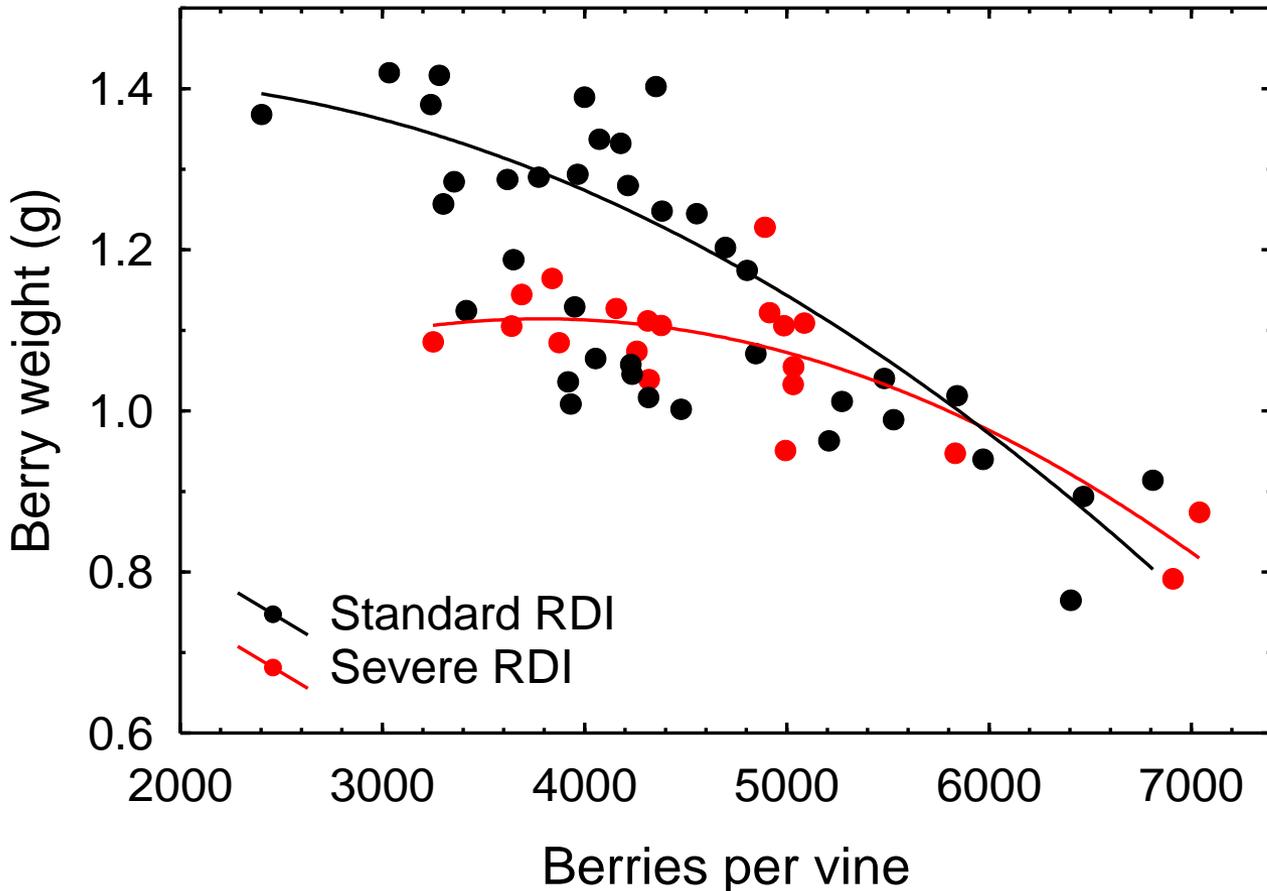


- Less water before veraison → Smaller berries
- Berry size is determined before veraison
- Skin stiffens at veraison → Berry would rather split
- It is difficult to manipulate berry size after veraison

Keller (2015); Keller et al. (2015)

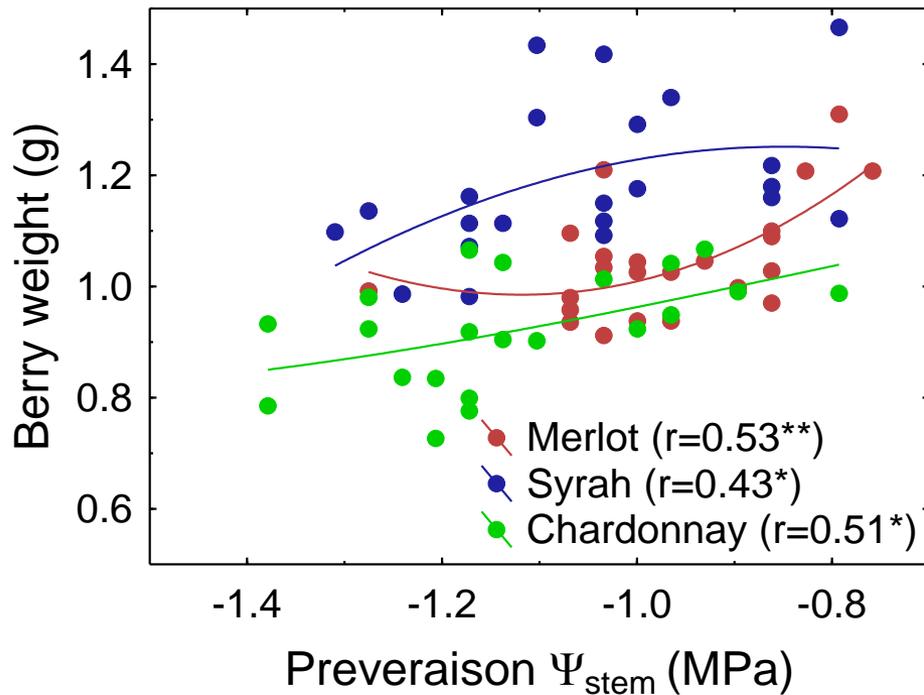


# Keep in mind: Vines do compensate



- Too little crop can lead to larger berries
- Compensation happens before, not after, veraison
- Prevention requires more severe preveraison water deficit

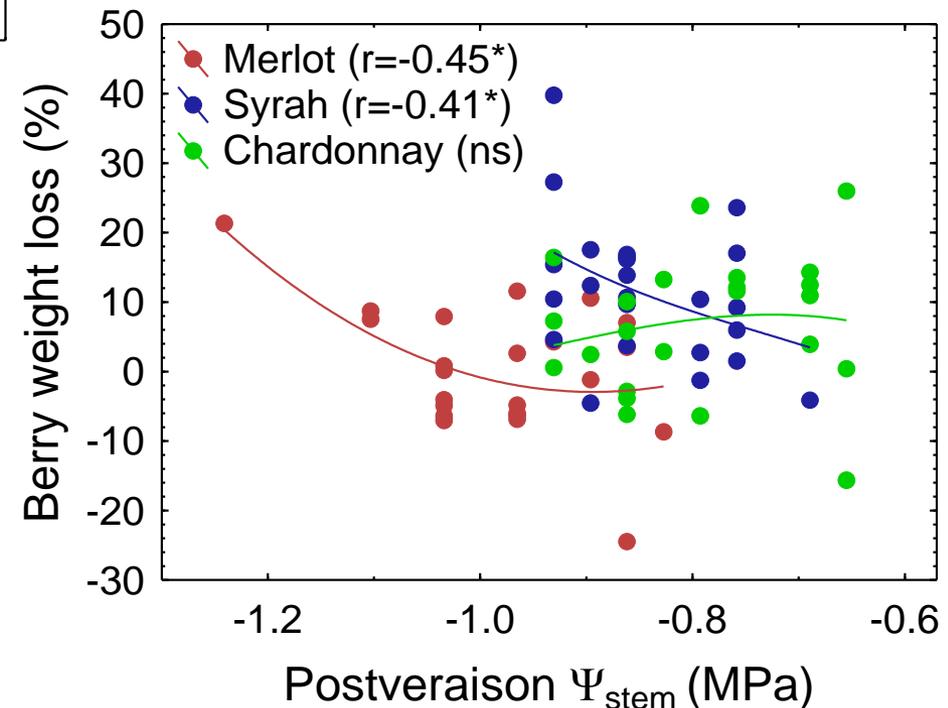
# Irrigation dilutes fruit quality – really?



More water before veraison increases berry size



More water after veraison decreases berry shrinkage

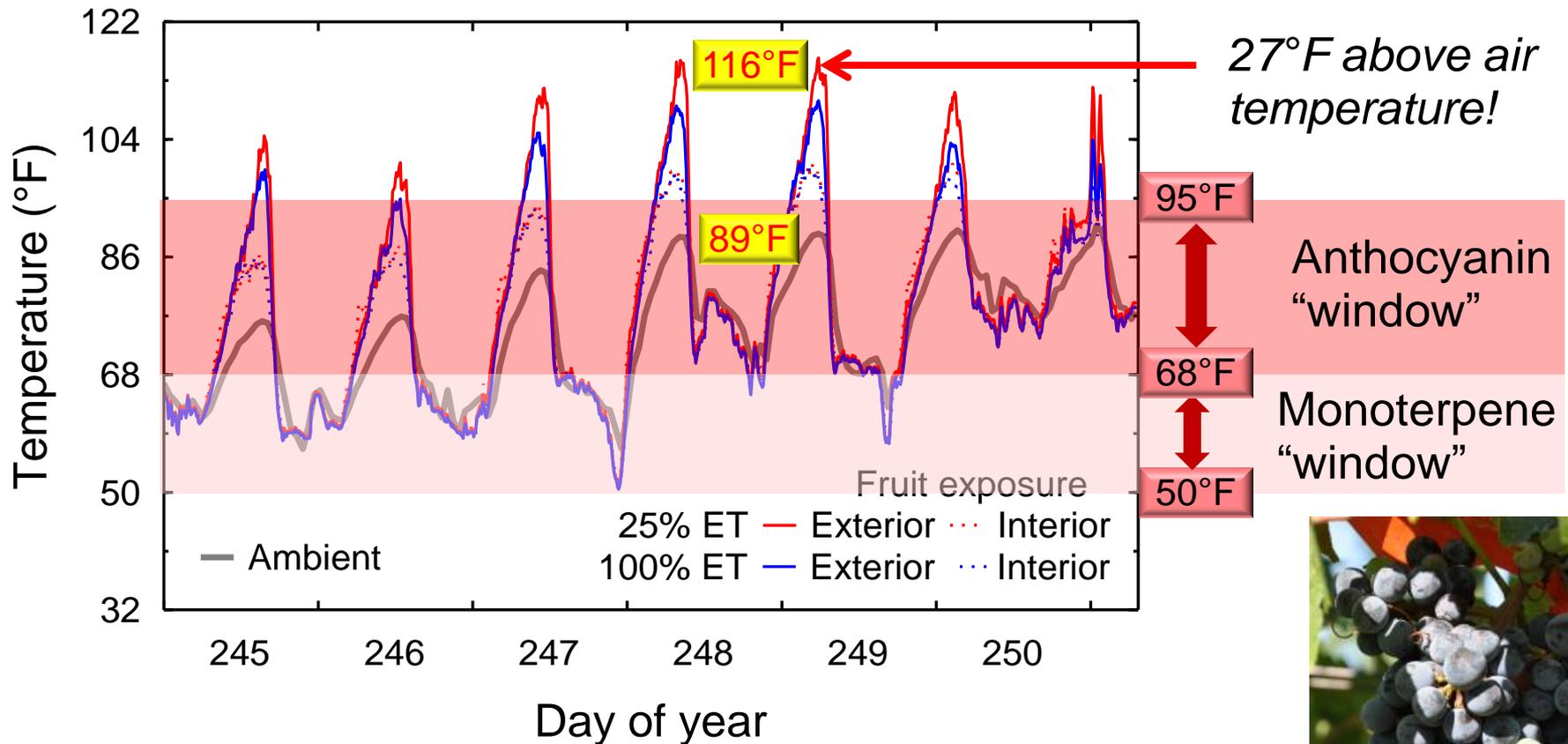


# All grapes: Less water means more control



- Less water → Lower vigor, canopy density → Less hedging
- Open canopy → More sun exposure → Less leaf removal
- Less water → Less weed growth → Less herbicide, tilling

# It's not just about berry size

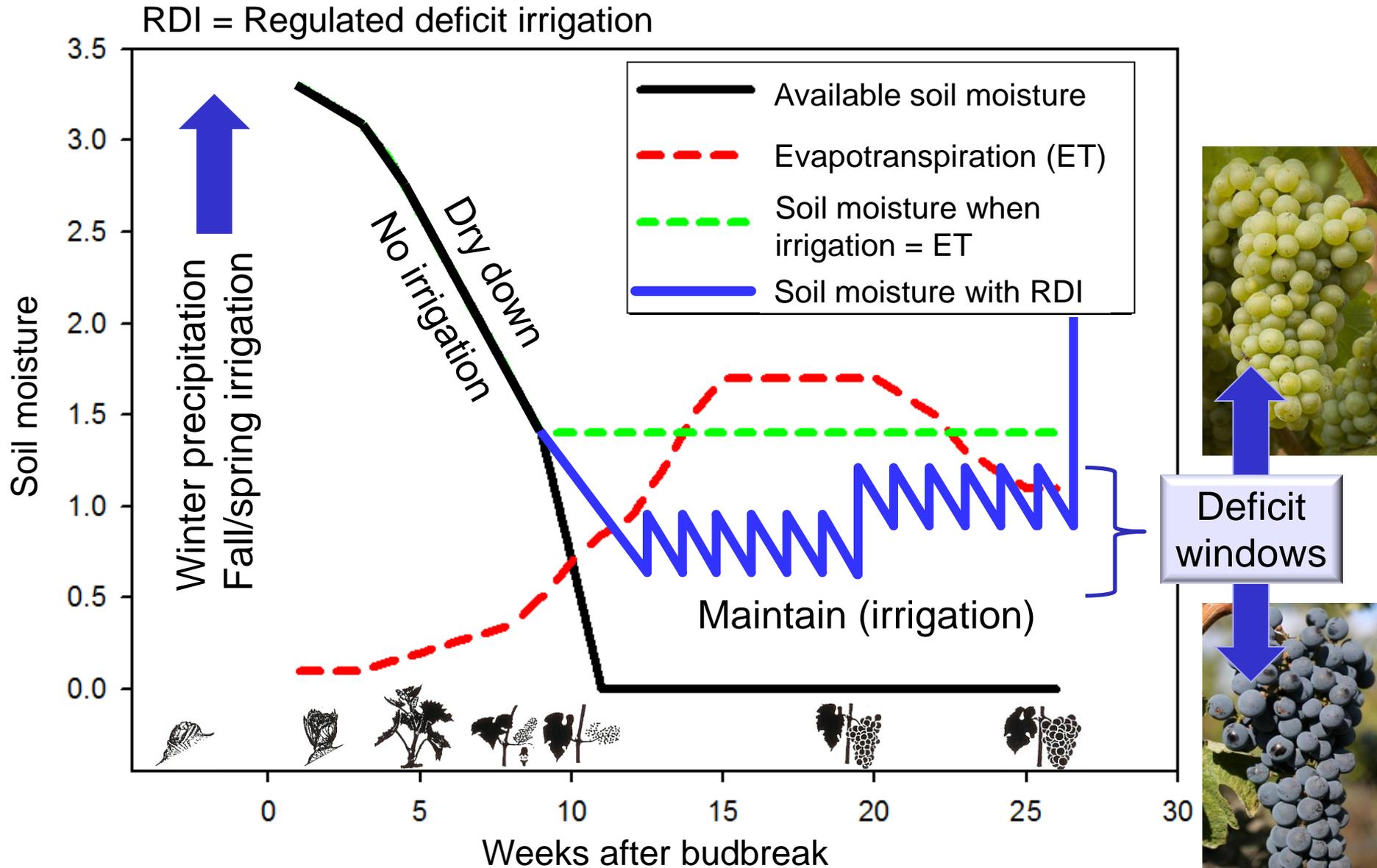


- Water deficit → Small berries, low vigor
  - Open canopy, restricted shoot growth
  - High cluster sun-exposure (light and temperature!)
- Exposed berries are warm berries
- Optimize color, tannin, flavor, aroma



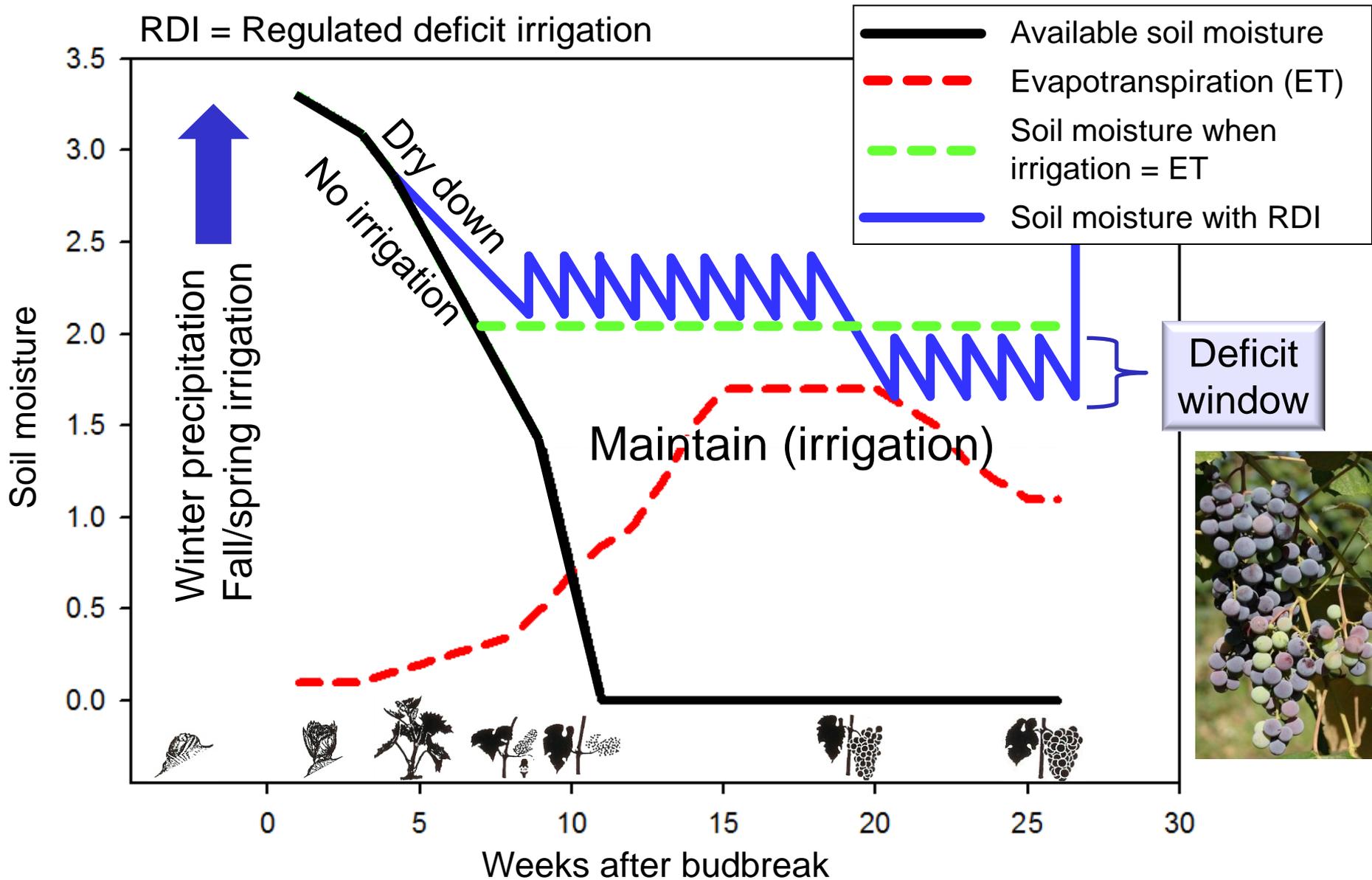
Keller et al. (2016)

# How to RDI for wine grapes



Shift deficit windows up or down depending on variety and production goals.

# How to RDI for juice grapes



ET = Vineyard evapotranspiration = Water evaporation from plants and soil

# Matching strategies: Wine vs. juice grapes

- Timing and extent of water deficit depend on production goals
- **Red wine grapes:** Low to moderate yields and small, sun-exposed berries are desirable
  - Moderate to severe preveraison water deficit (25 – 50% ET)
  - Big, bold red wines (less stress for lighter wine styles)
- **White wine grapes:** Moderate yields are desirable, but berry size and sun exposure are less important (white skins do tan!)
  - Mild preveraison water deficit (50 – 75% ET)
  - Elegant, crisp white wines (less stress for fruitier wine styles)
- **Juice grapes:** High yields and big berries are desirable, but sun exposure is less important (heat stops color!)
  - No to mild preveraison water deficit (75 – 100% ET)
  - Plentiful, fruity juice concentrate

## **Do's for all grapes:**

- Some postbloom drydown (canopy control)
- Mild postveraison deficit (ripening)

## **Don'ts for all grapes:**

- Early stress (productivity)
- Late stress (shriveling)