

# Vine Physiology & Weather Extremes Leading to Harvest

NVVTG – NVWTG Joint Annual Meeting  
May 21, 2009

Phillip Freese

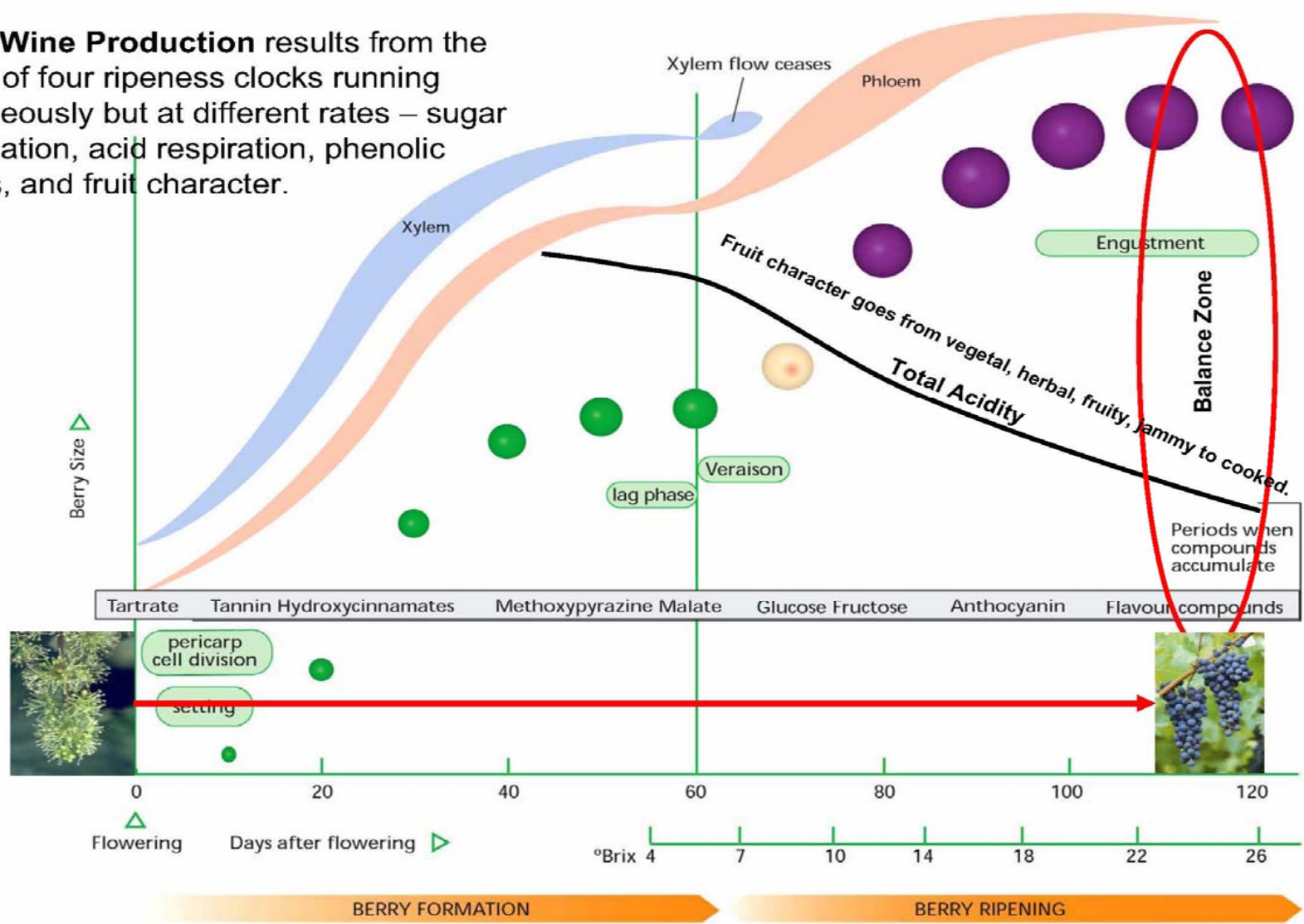
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**Quality Wine Production** results from the balance of four ripeness clocks running simultaneously but at different rates – sugar accumulation, acid respiration, phenolic ripeness, and fruit character.



*Australian Viticulture* from text: "Ripening berries – a critical issue" by Dr. Bryan Coombe and Tony Clancy (Editor, *Australian Viticulture*), March/April 2001. Illustration by Jordan Koutroumanidis and provided by Don Neel *Practical Winery and Vineyard*

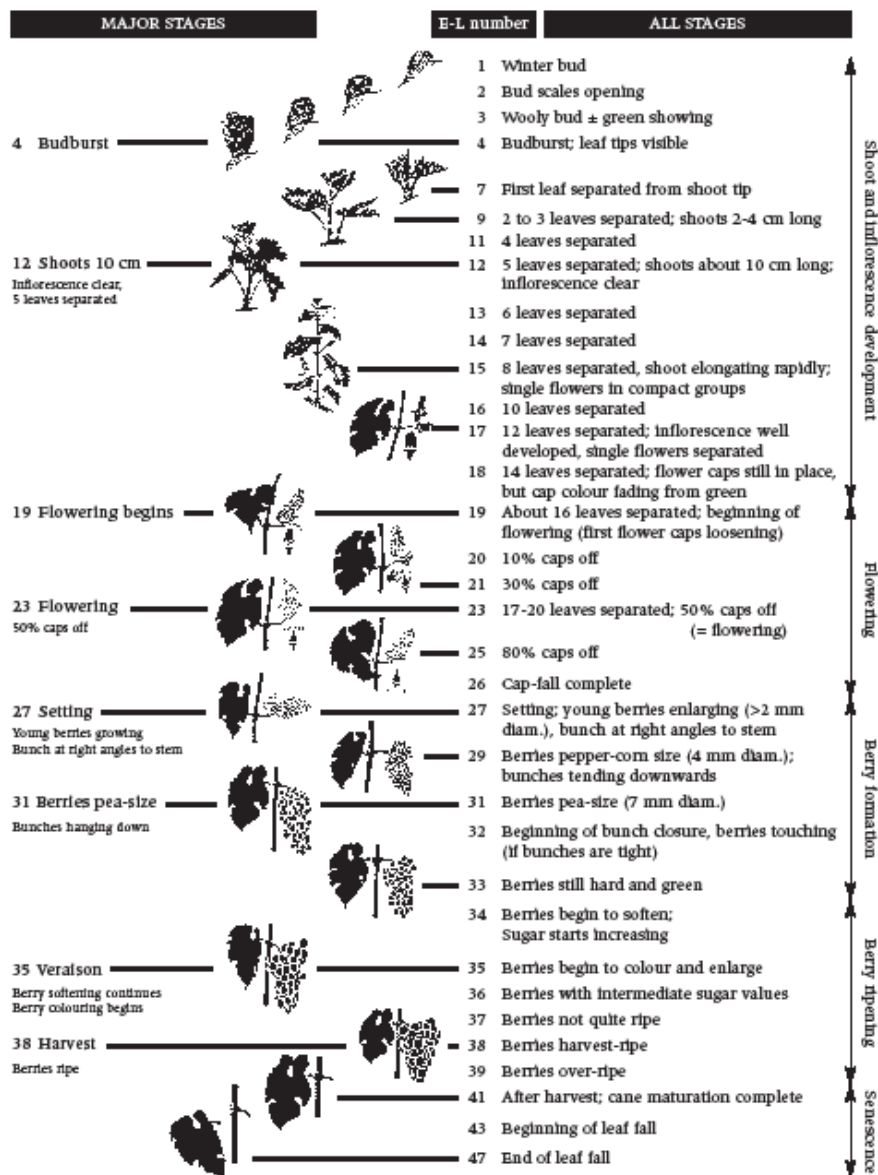


Figure 7.3 Modified E-L system for identifying major and intermediate grapevine growth stages (revised from Coombe 1995). Note that not all varieties show a woolly bud or a green tip stage (May 2000) hence the five budburst stages in the modified original 1995 system have been changed slightly by removing stage 4 and allocating the definition of budburst to what was formerly stage 5. Revised version of "Grapevine growth stages - The modified E-L system" Viticulture 1 - Resources, 2nd edition 2004. Eds. Dry, P. and Coombe, B. (Winetitles)

# Phenology (Timing of Vine Events)

- **Bud-burst to Flowering – variable number of days since temperature is limiting factor**
- **Flowering to Verasion: approx. = 65 days**
- **Verasion to Harvest: approx. = 45 days**
- **Timing within an event is a measure of variability**
  - **Number of elapsed days from 5% to 95%**
- **Sum for Flowering to Harvest: approx. = 110+/- days!**  
**< Longer for Cabernet → 120 days >**
- **Elapsed days is very regular for vineyard – little effect of the weather each season – in most areas**
- **Very hot growing areas and/or stressed vines take longer to ripen**

# Primary vs. Secondary Effectors

- **Primary effectors:**
  - The action gives you a direct observable and measurable outcome
    - Sunlight → Heat on your skin
- **Secondary effectors:**
  - The action affects something that then causes another effect (Think dominos...)
    - Sunlight → Heat on your skin → Sunburn → Pain
    - Sunlight → Heat on grape skins → Phenolic substances that help protect the berry → Bitter and/or astringent taste
  - \*\* Note: there are lots of complex chemistry and variability steps in the causes and the outcome from this example
  - \*\* Canopy density, soil characters, water holding capacity, nutrient status, row orientation, varietal differences in sensitivity to sun/heat, cloudy area, aspect (hillside vs. flat vineyard, etc. etc.

# Fruit exposure and resulting heat load and thermic stress

# Fruit Exposure and Temperature

43<sup>0</sup> C = 109<sup>0</sup> F

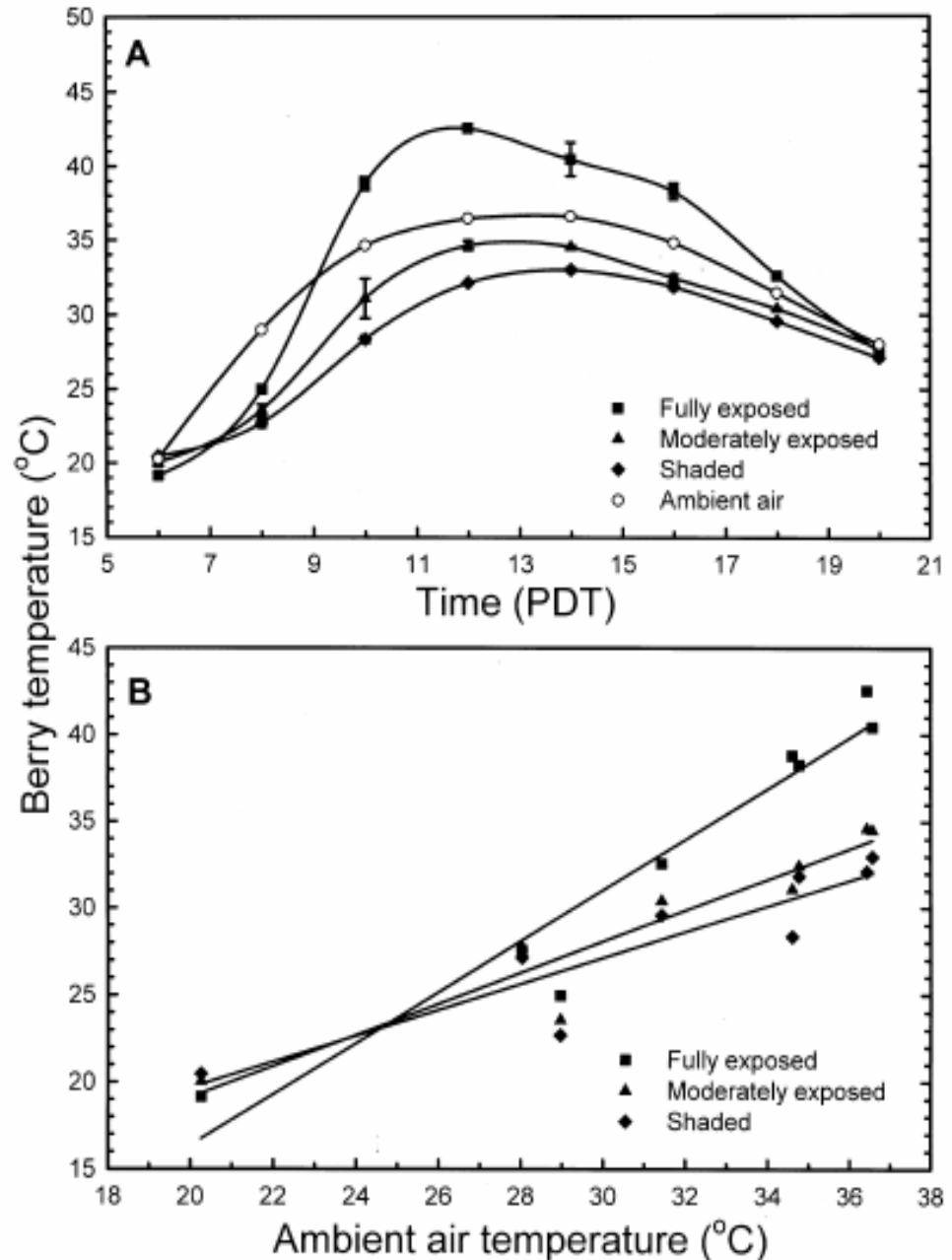
35<sup>0</sup> C = 95<sup>0</sup> F

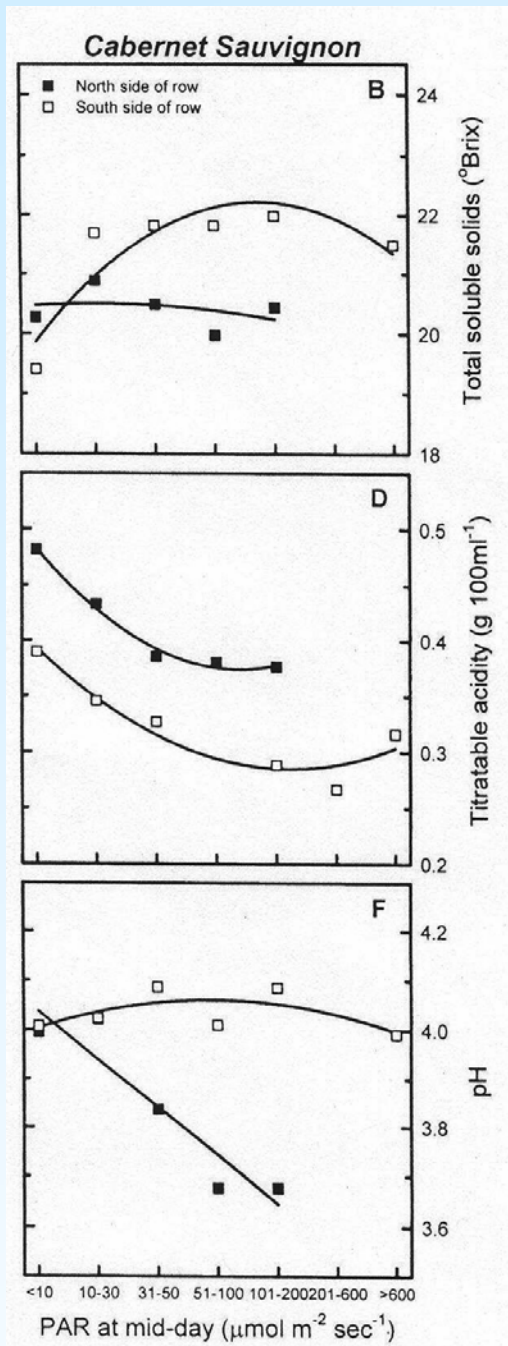
- Optimum temperature for enzymes in anthocyanin pathway is between 17 – 26 °C (62 – 79 F)

- Red grapes are up to 10 °C warmer than ambient for red fruit in direct sun

\*\* 85 F (29 C + 10 C) → 102 F

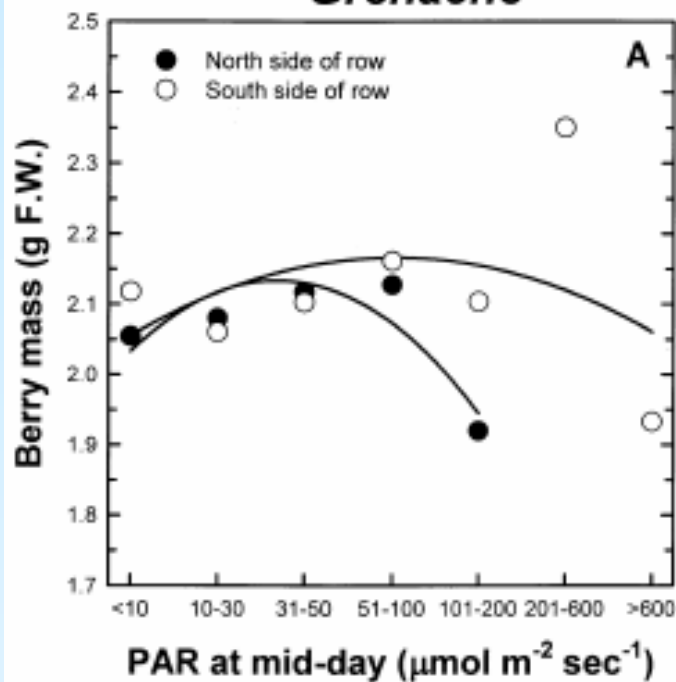
Bergqvist, et. al. 2001



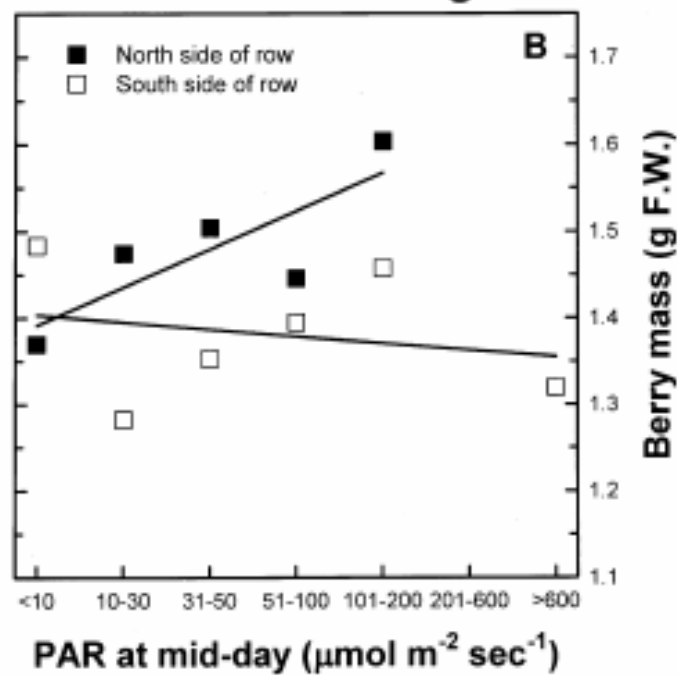




### Grenache



### Cabernet Sauvignon

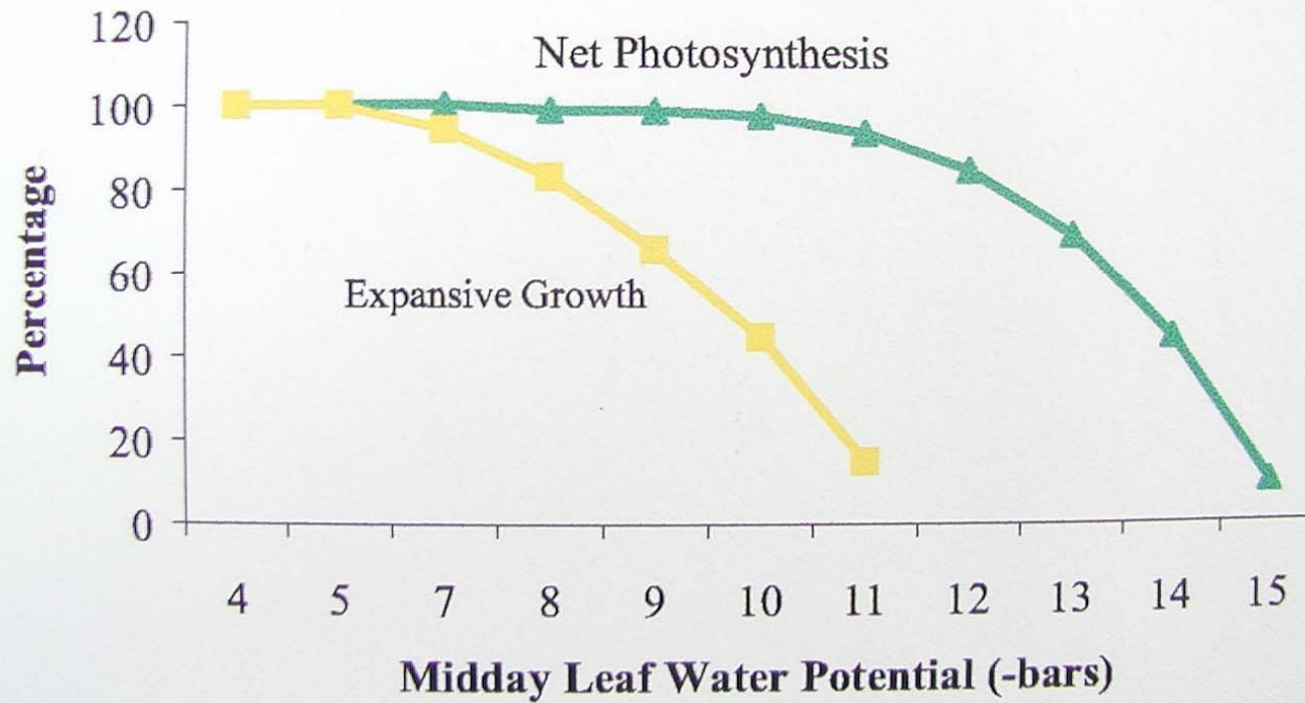


Appropriate time and severity of water stress  
to slow vegetative growth but allow for full  
vine function:

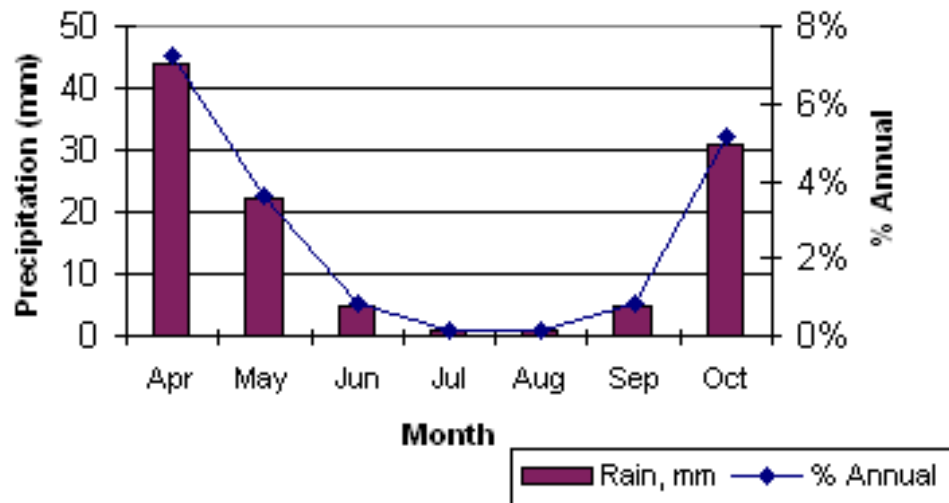
# Over-arching water stress management:

- Elaborate a “sufficient canopy”
- Slow shoot elongation 2 weeks pre-veraison  
(Must know when veraison will occur – See phenology)
- Approaches post-veraison to pre-harvest
  - Non-irrigation
  - Managed to a defined stress point  
(c.f. LWP)
  - “New” approach such as Prichard, et. al.  
(Full Etc replacement post-20 Brix)

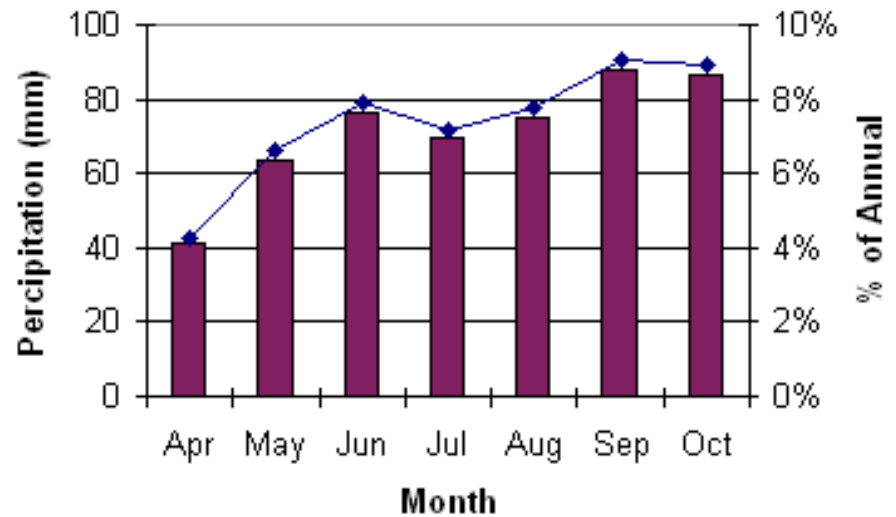
Figure D-8. Relative rate vs. leaf water potential



## Napa, US (Napa Valley)



## Bordeaux, France

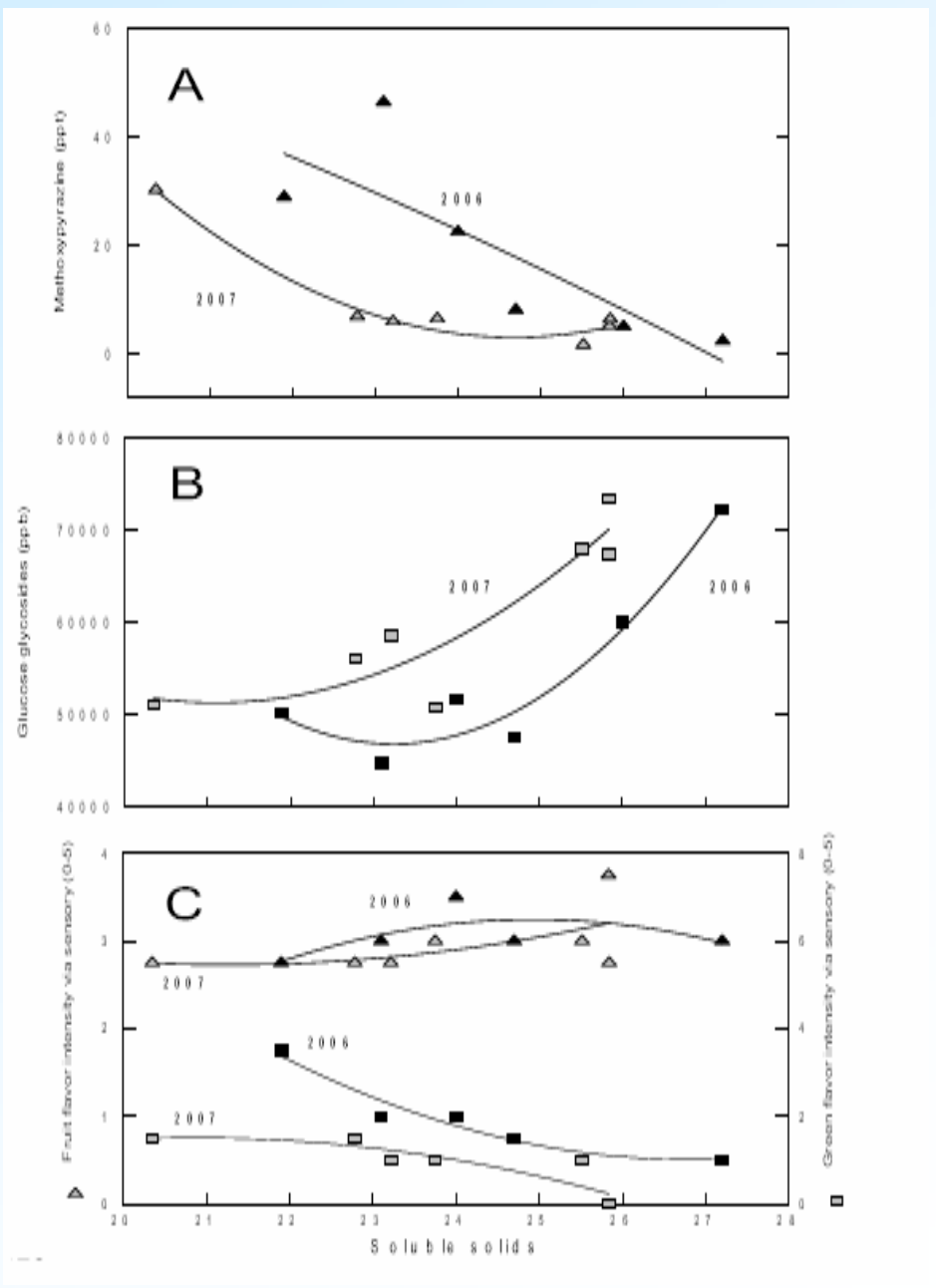


## Evolution of flavorants in Cabernet Sauvignon:

<b>Vegetation</b>	<b>→ Herbaceous</b>	<b>- Unripe Fruit</b>	<b>→ Red Fruit</b>	<b>→ Black Fruit</b>	<b>→ Jam</b>
Plant matter	Straw, herb, vegetal, tobacco	Green apple, citrus rind	Cherry, strawberry, raspberry, cranberry	Plum, blackberry, black cherry	Prune, date, raisin

**Extended maturation effects on vegetative notes:**

**2006 & 2007**

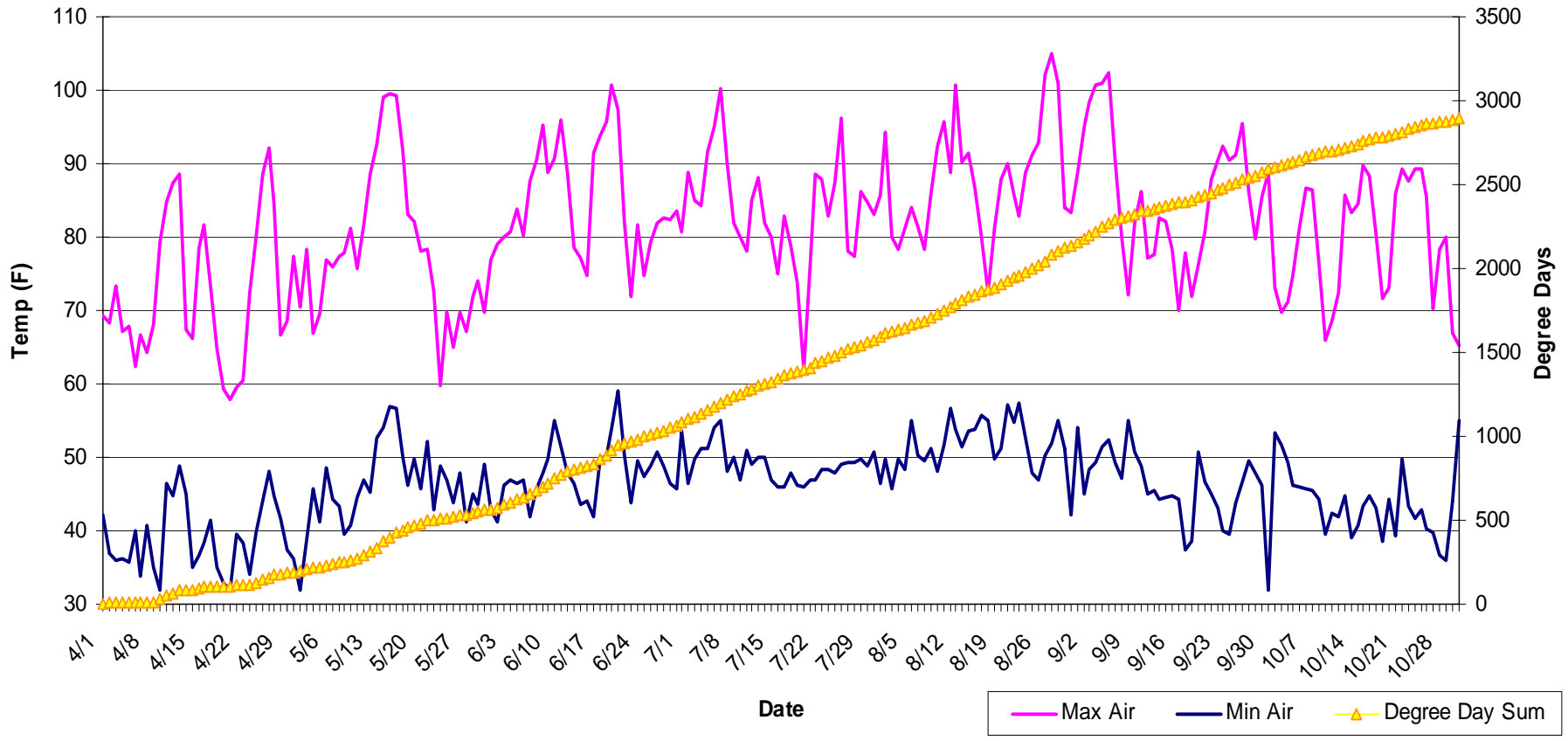


# Ripening:

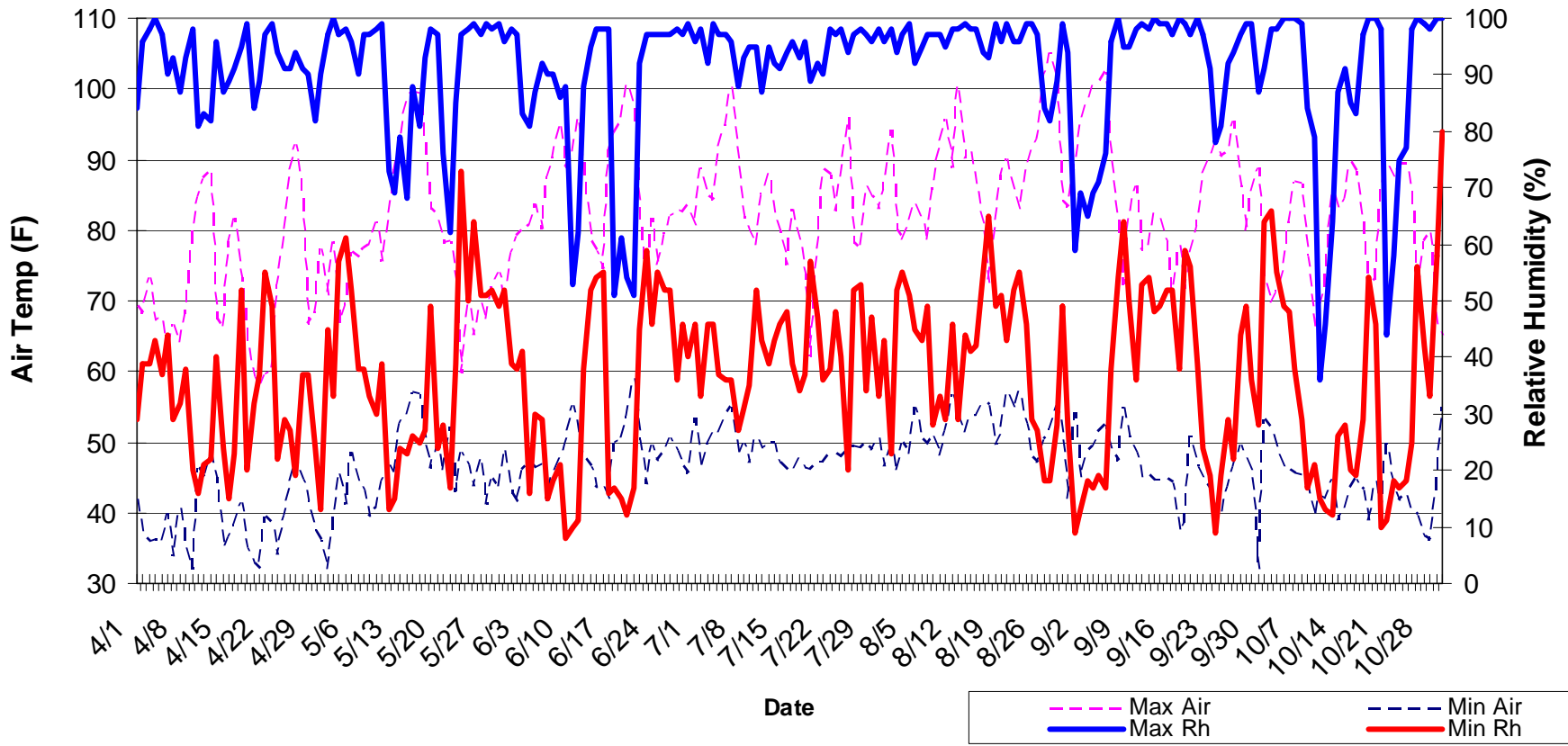
- Photosynthesis produces sugar – ‘attractant’
  - Drives transport of phloem sap (water and sugar to the fruit and vine structure)
- Malic acid is energy source for ripening
  - Cool nights preserve MA
  - ? – temperatures at or below 50F and physiology
  - Night reactions, phosphorous and photosynthesis
- Ripening is highly temperature dependent
  - Individual pathways and their development temps



### Oakville 2008: Max, Min & Degree Day Accumulation April 1 - Oct 31, 2008

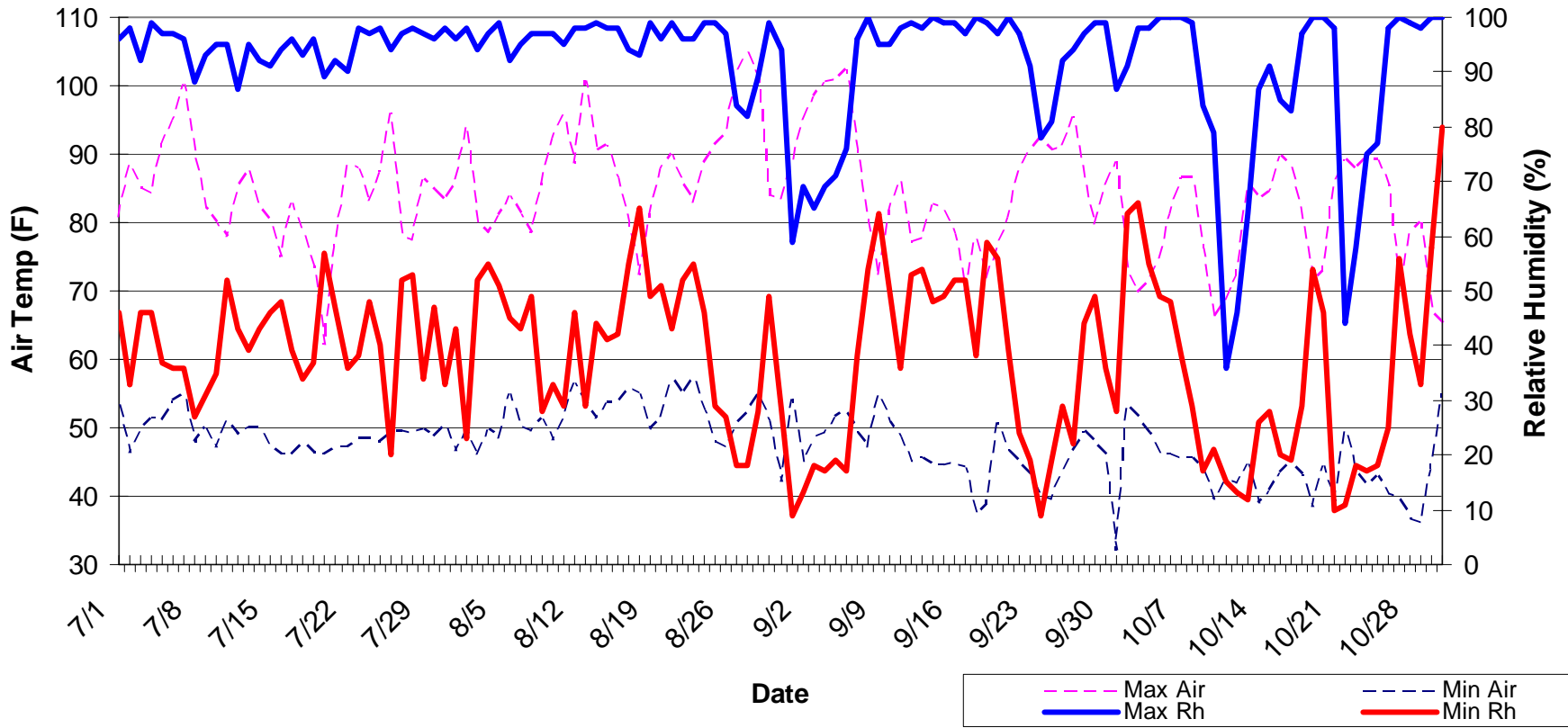


### Oakville 2008: Temperature & Relative Humidity April 1 - Oct 31, 2008

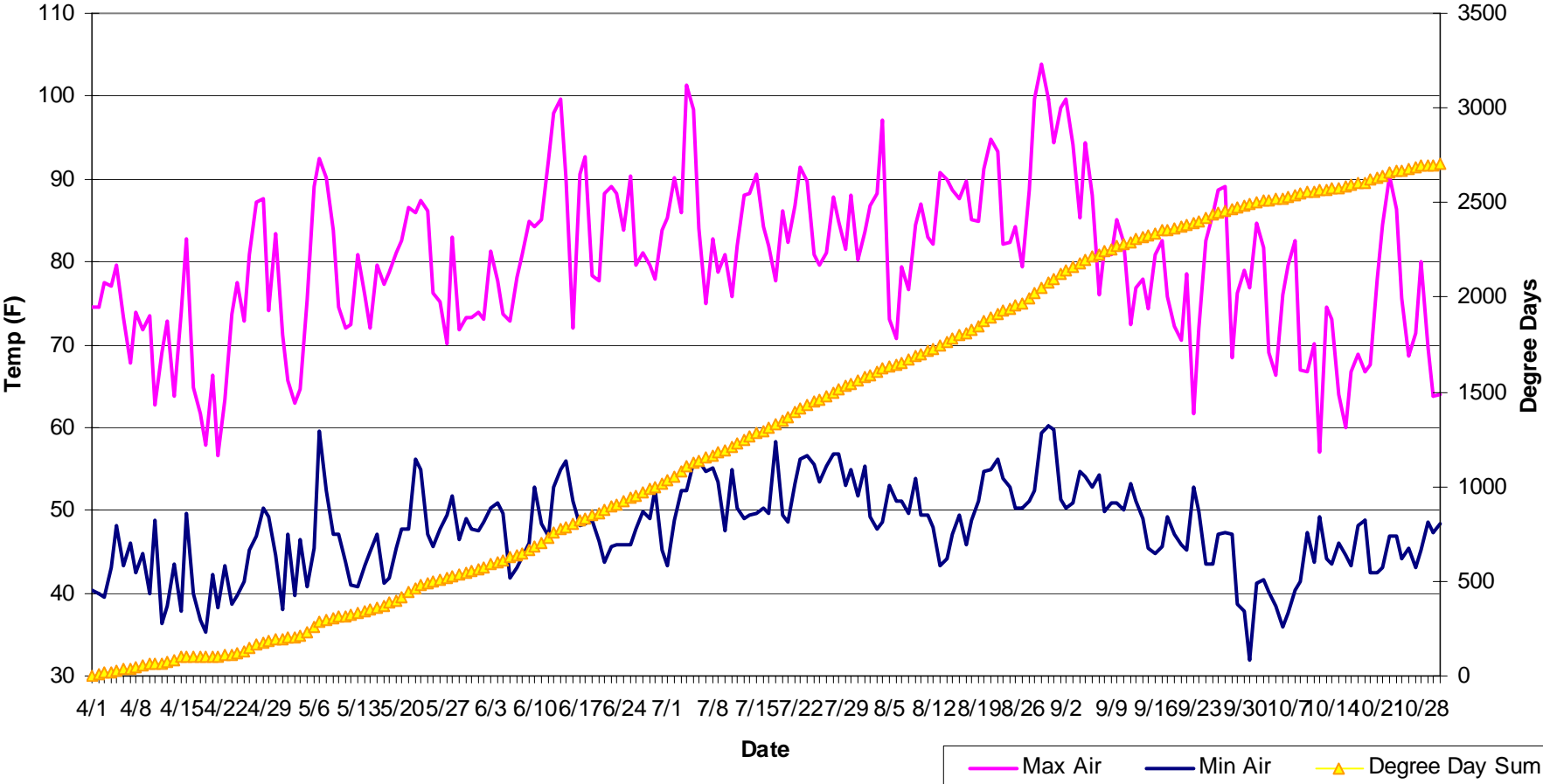


# Oakville 2008: Temperature & Relative Humidity

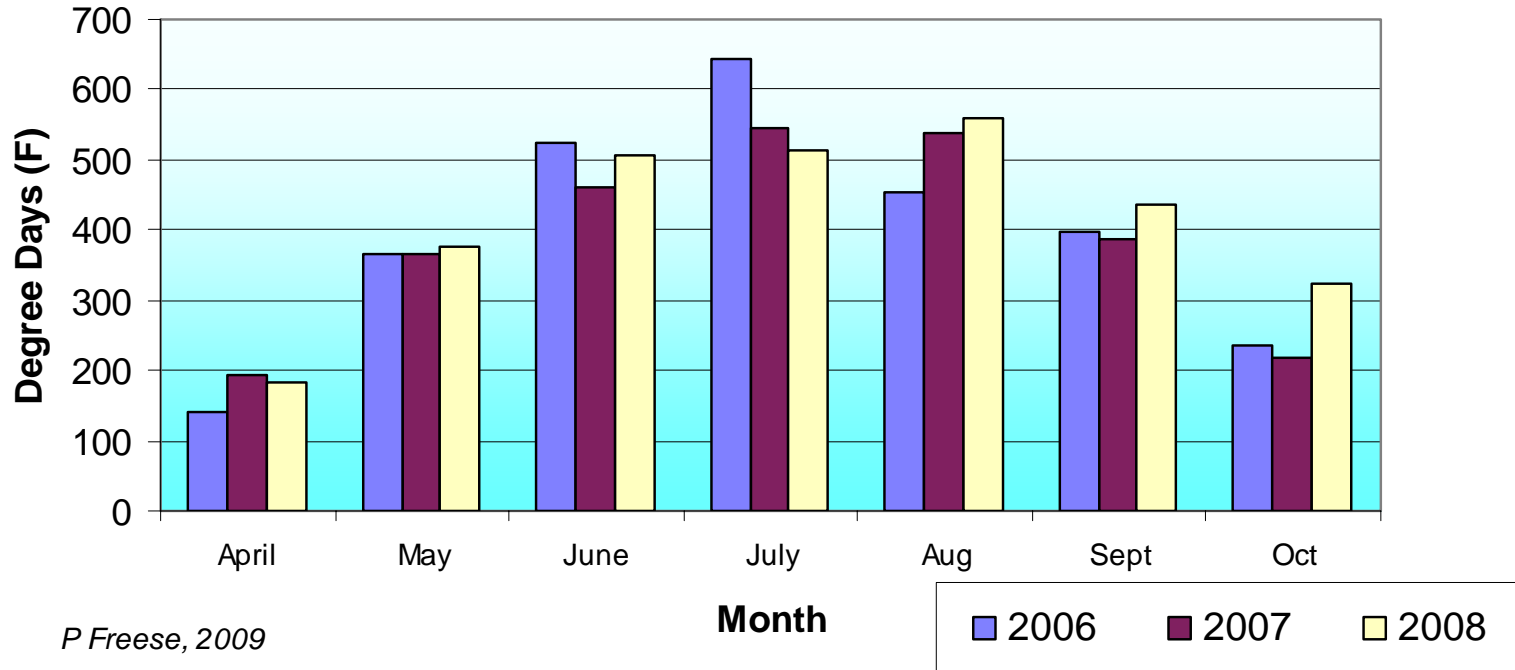
## Jul 1 - Oct 31, 2008



### Oakville 2007: Max, Min & Degree Day Accumulation April 1 - Oct 31, 2007



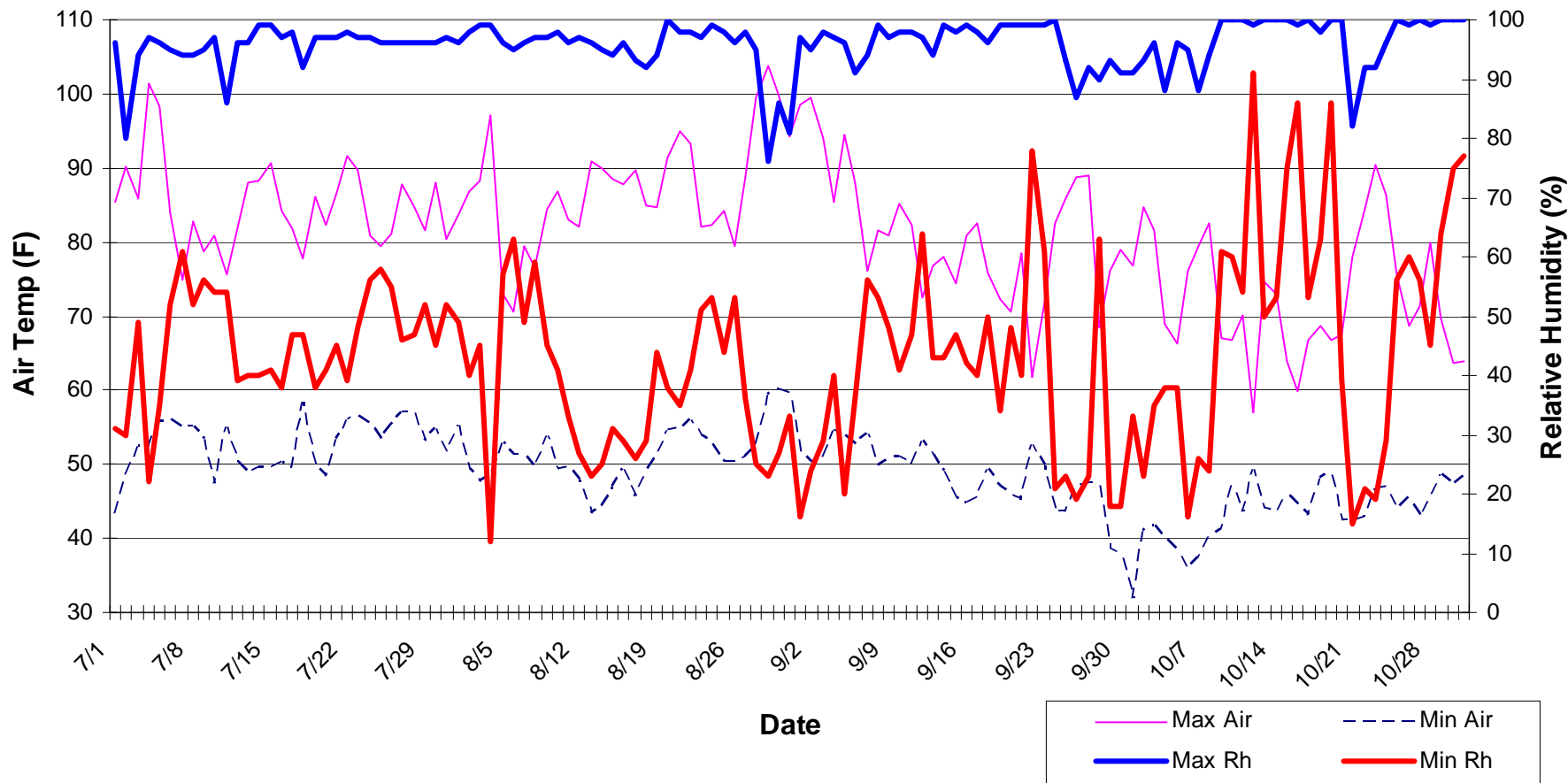
## Oakville CIMIS: Degree Day Per Month



Total Degree Days		
2006	2007	2008

2,762	2,706	2,892
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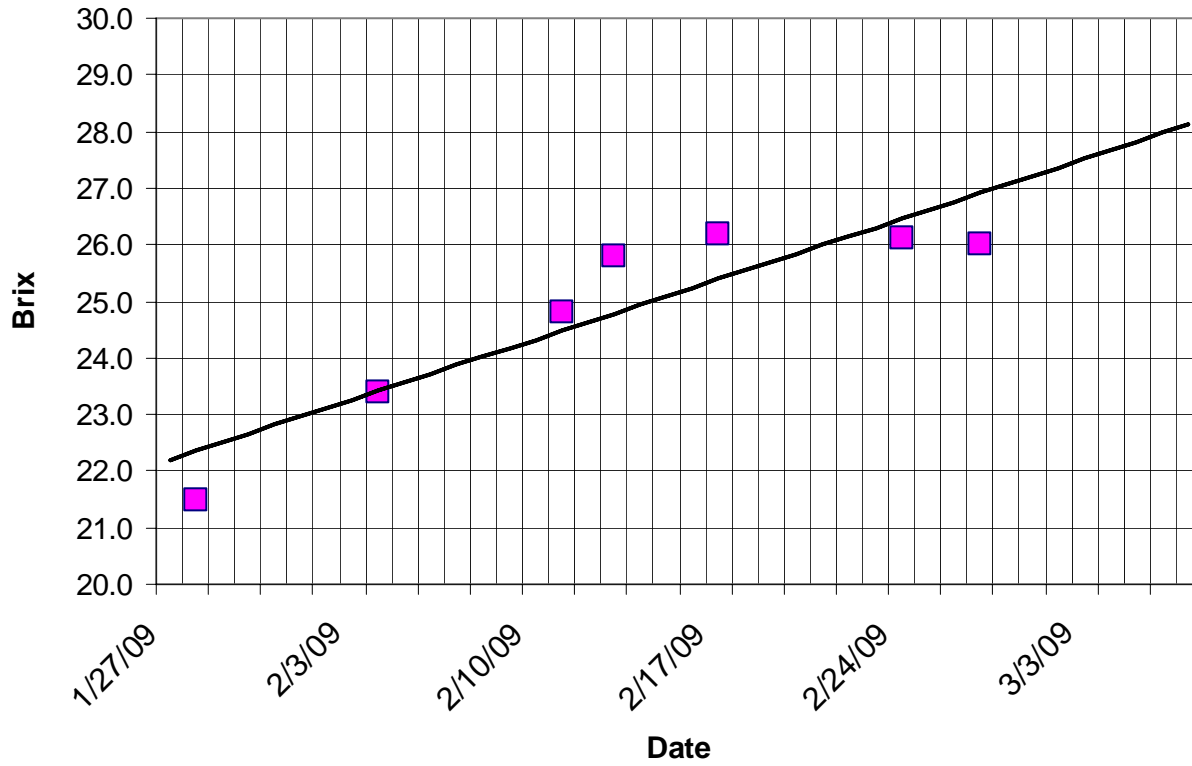
### Oakville 2007: Temperature & Relative Humidity July 1 - Oct 31, 2007



# CS Block O 2009

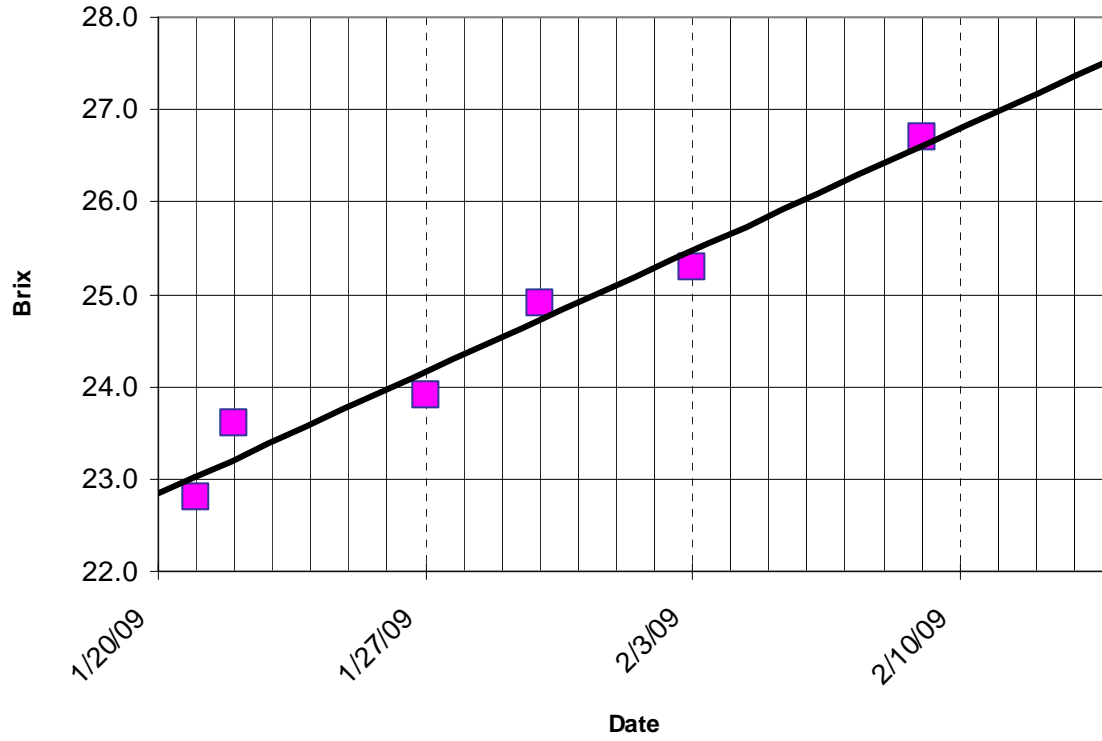
$$y = 0.1518x + 22.052$$

$$R^2 = 0.8164$$



Merlot Block Z 2009

$y = 0.1206x - 4737.4$   
 $R^2 = 0.9038$





***Climate is what we expect;***

***Weather is what we get***

***Mark Twain***

Questions and discussion....