Prevention and mitigation of heat damage

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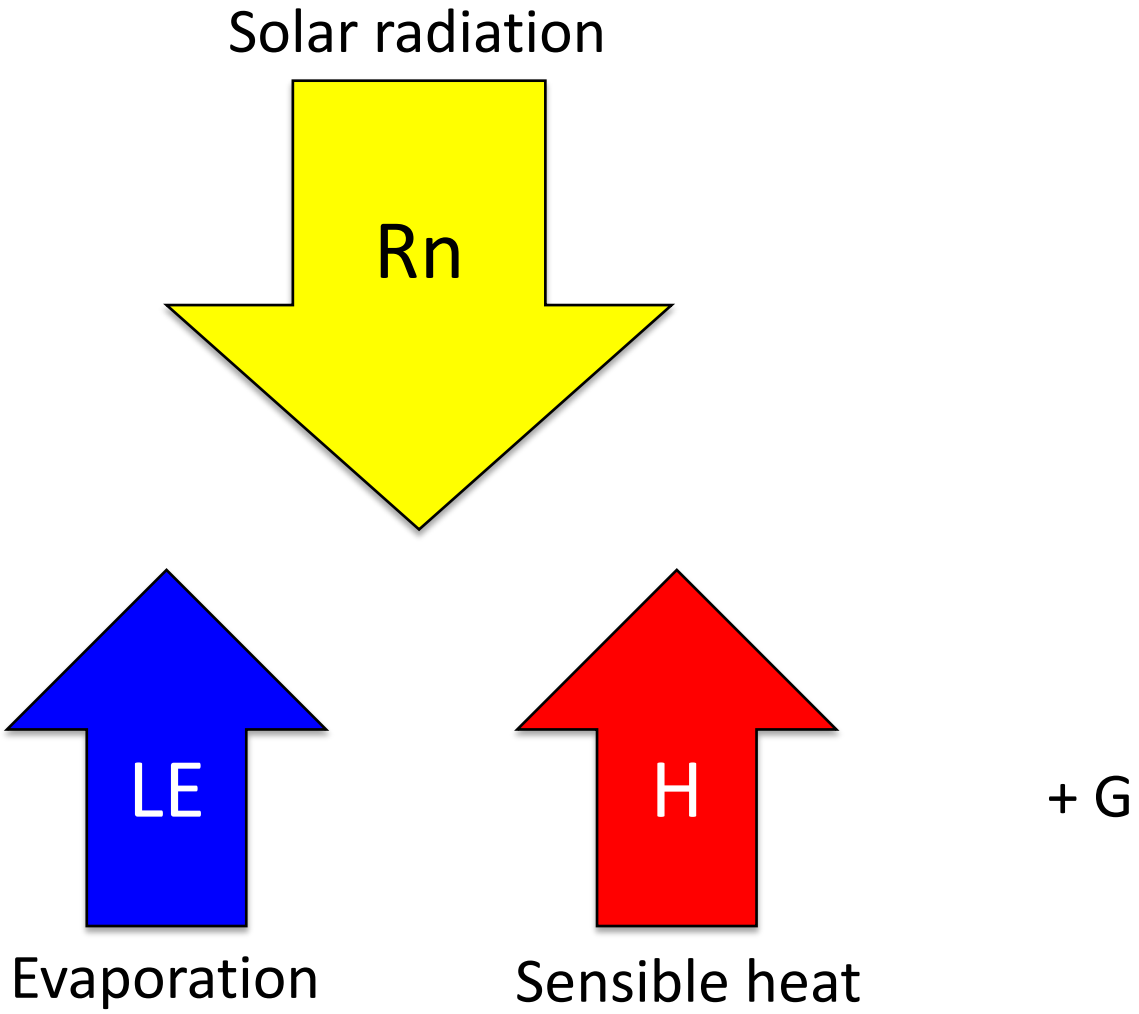
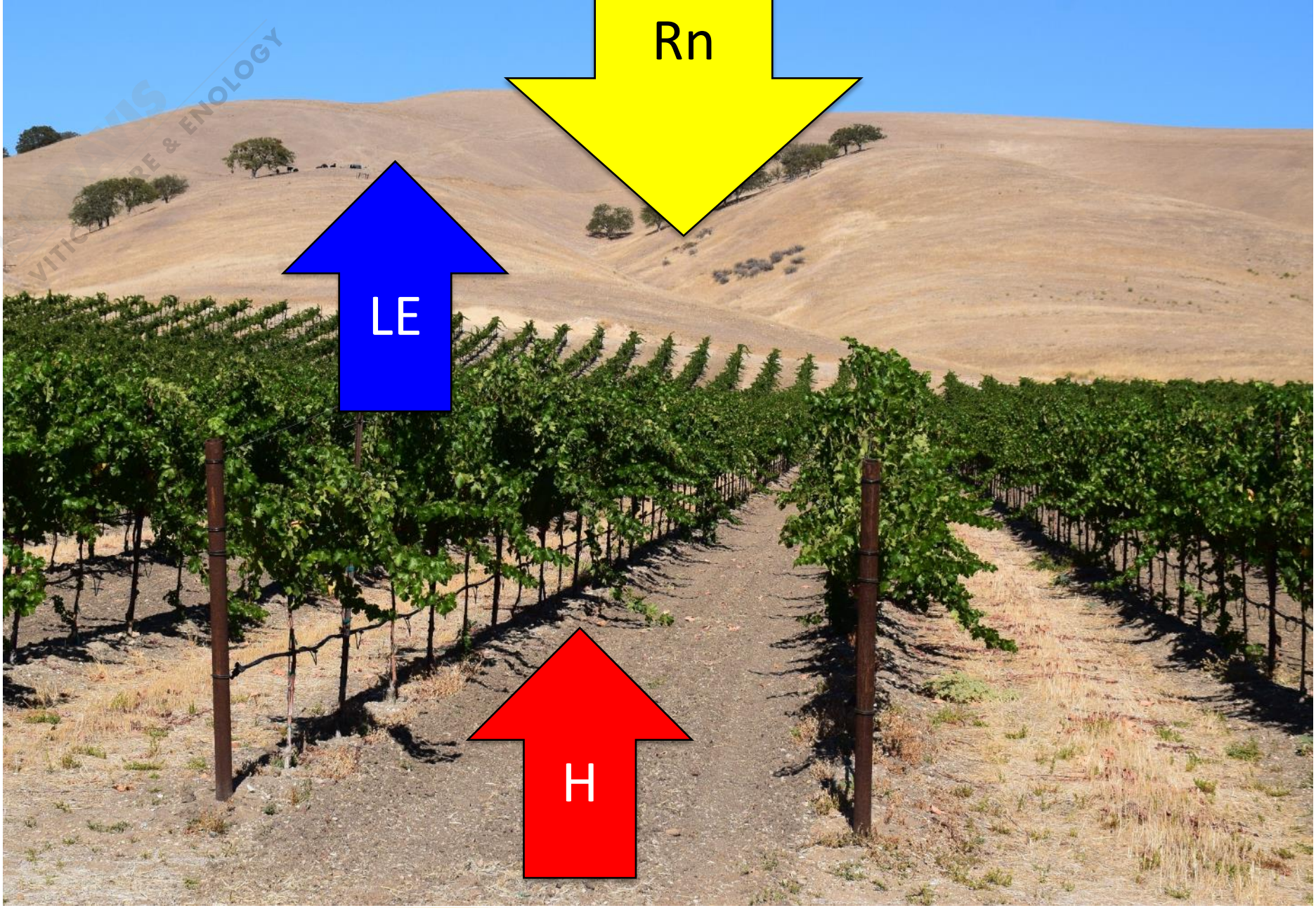
Weather conditions leading to heat events

- Heat wave formation
  - Stagnant high pressure systems capture hot air
- Related to distant events
  - Storms in the Indian Ocean
  - Can help predict heat waves

Energy balance




Rn
LE
H

July 24 at 2 pm

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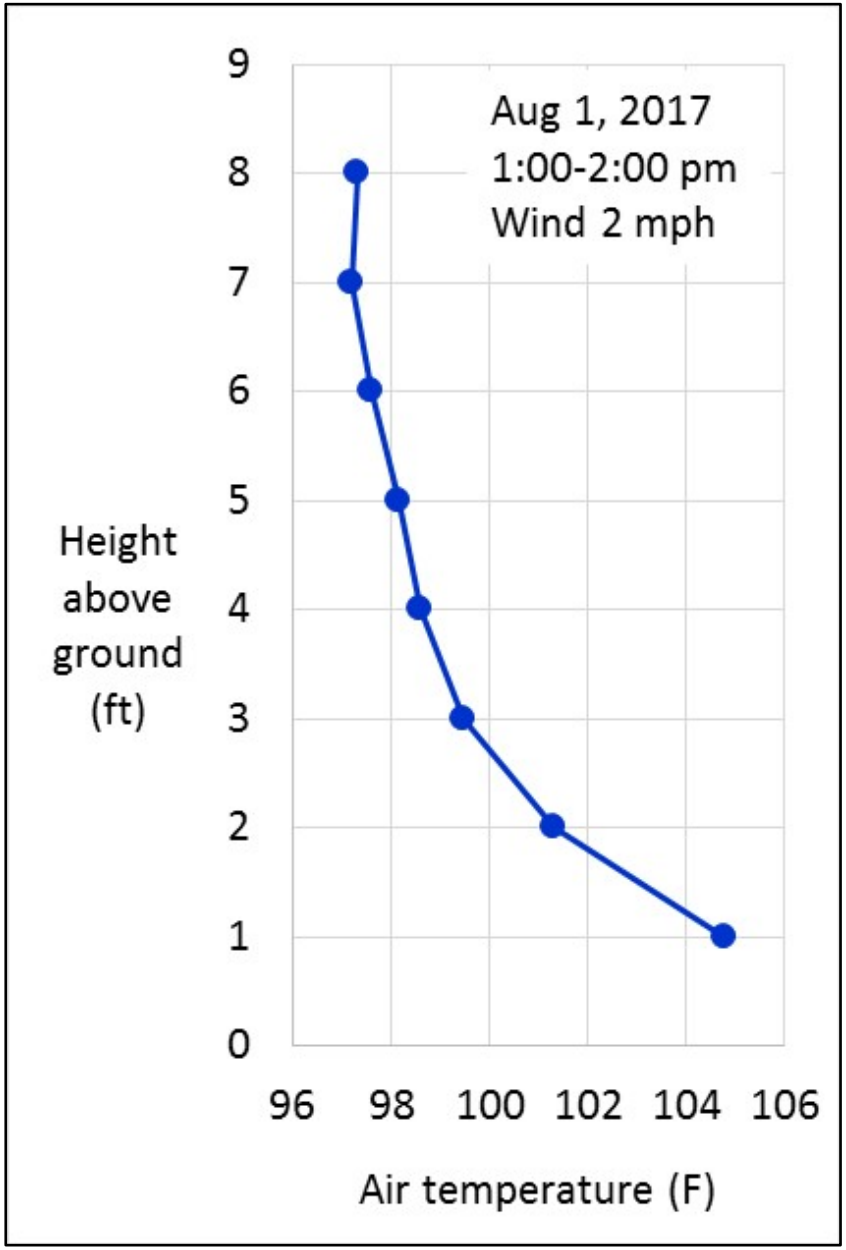
Aug 1, 2017
1:00-2:00 pm
Wind 2 mph
Height above ground (ft)
0
1
2
3
4
5
6
7
8
9
96
98
100
102
104
106
Air temperature (F)

Heat damage to vines

- Elevated air temperature
- Direct sunlight heating exposed berries
- Exacerbated by vine water stress
- Severe water stress >> defoliation
  - Makes everything much worse


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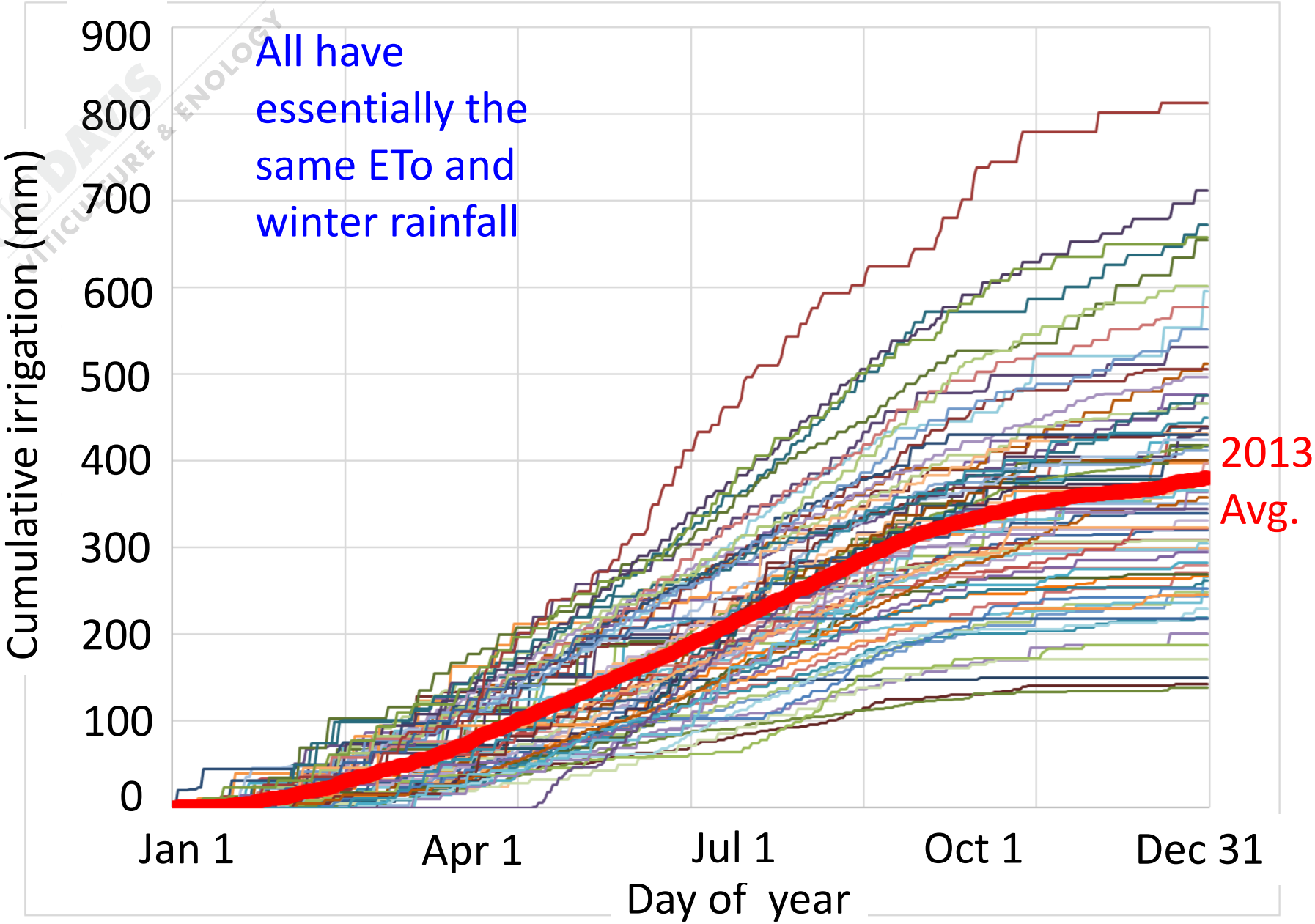
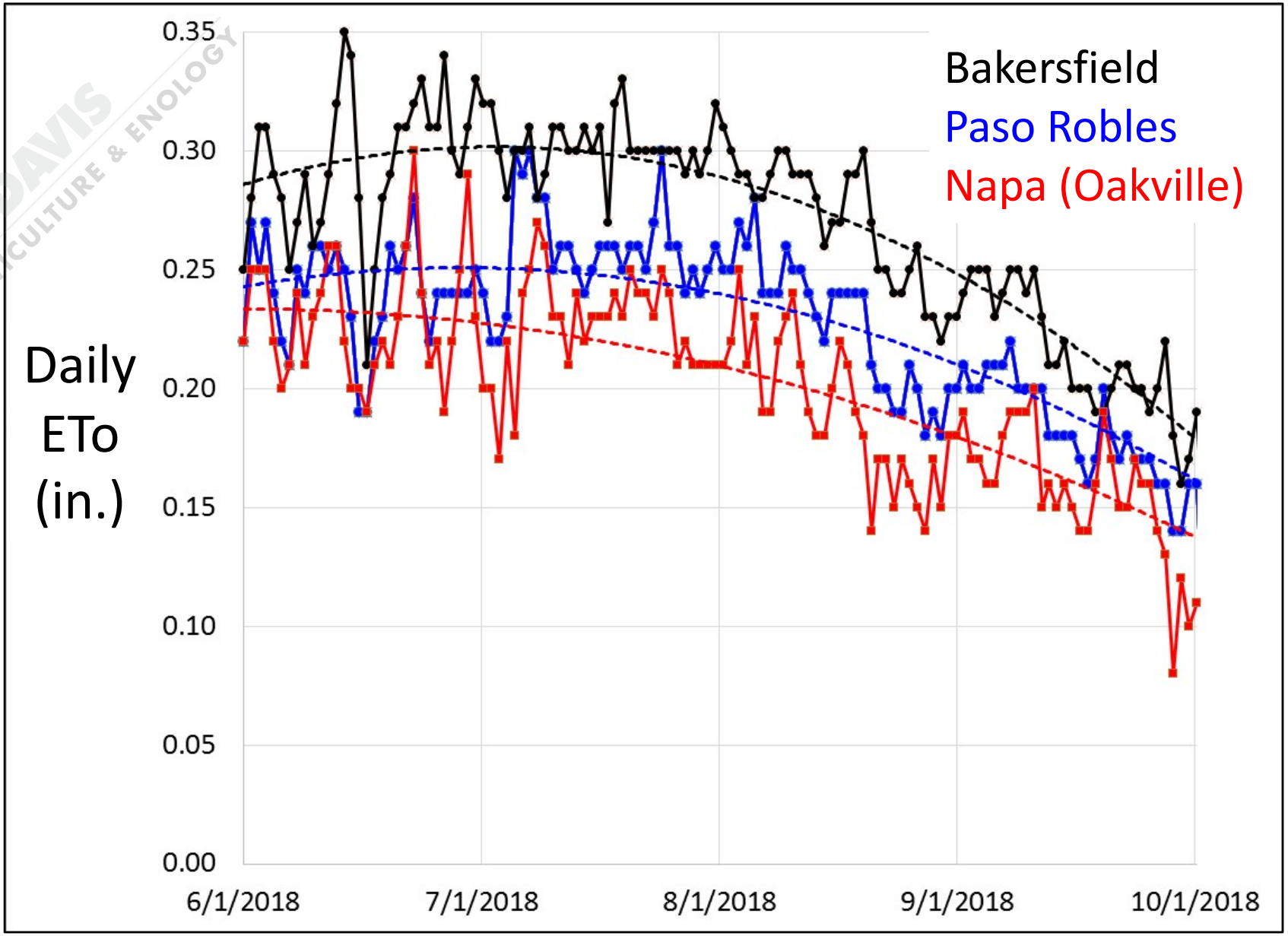
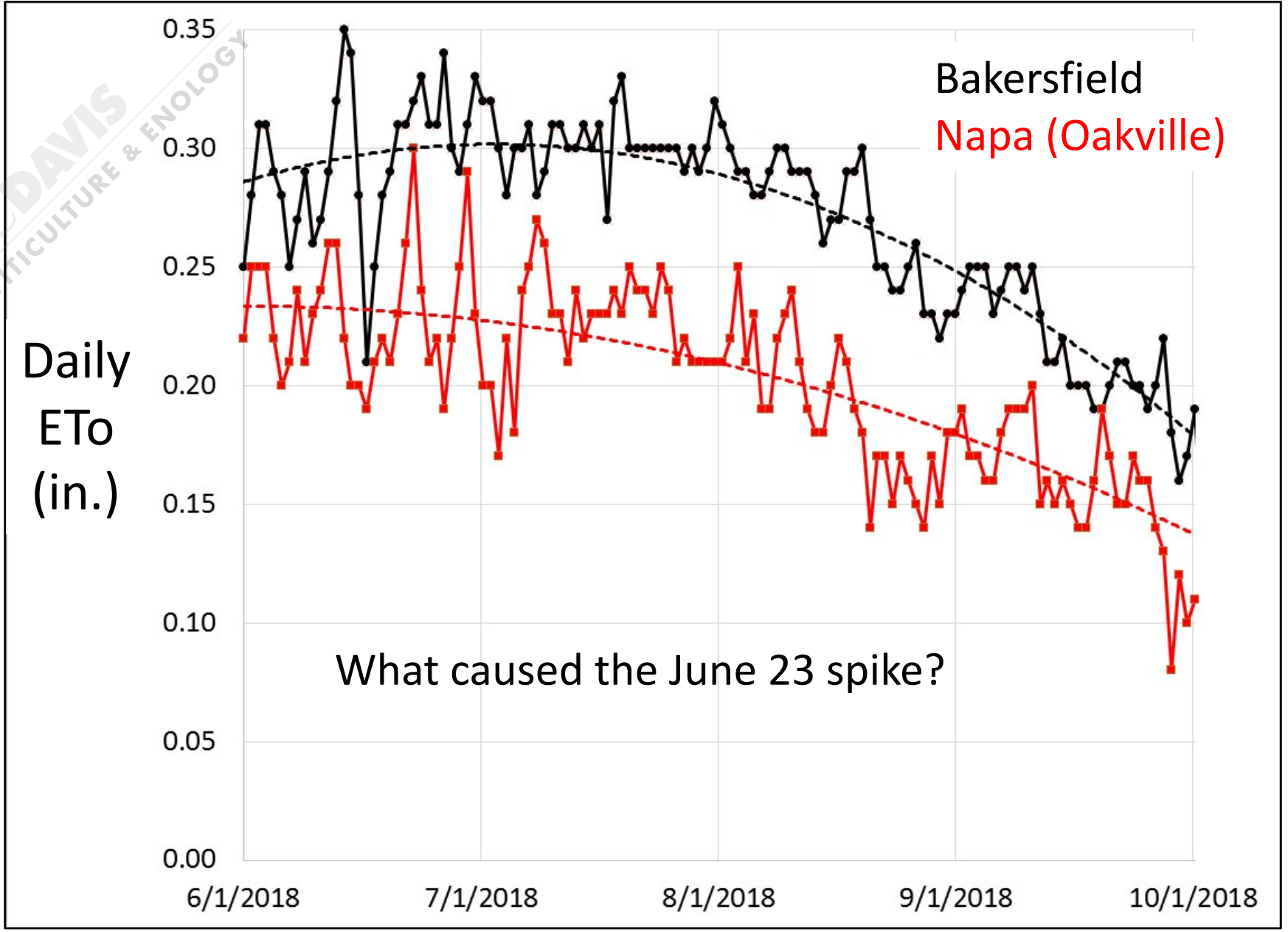
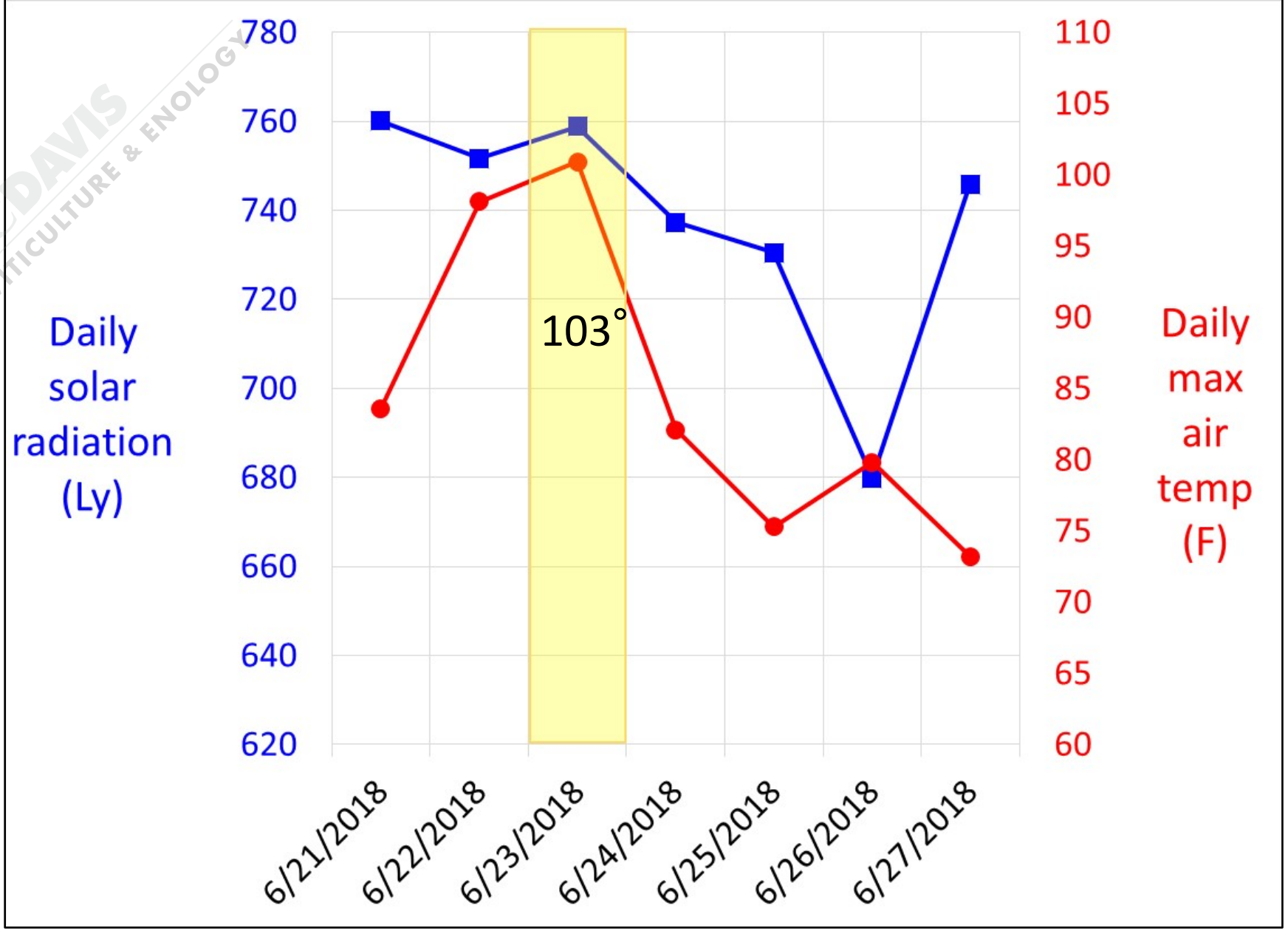

All have essentially the same ETo and winter rainfall
2013 Avg.
Cumulative irrigation (mm)
900
800
700
600
500
400
300
200
100
0
Jan 1
Apr 1
Jul 1
Oct 1
Dec 31
Day of year



DWR Spatial CIMIS



DWR Spatial CIMIS


Daily solar radiation (Ly)
780
760
740
720
700
680
660
640
620
Daily max air temp (F)
110
105
100
95
90
85
80
75
70
65
60
103°
6/21/2018
6/22/2018
6/23/2018
6/24/2018
6/25/2018
6/26/2018
6/27/2018

DWR CIMIS #77

Air temperature effect on ETo

- As temperature increases, so does ETo!
- Need to compensate with additional irrigation
- Can the irrigation system meet the extra demand?

Manage canopy for shading fruit

Grow enough canopy

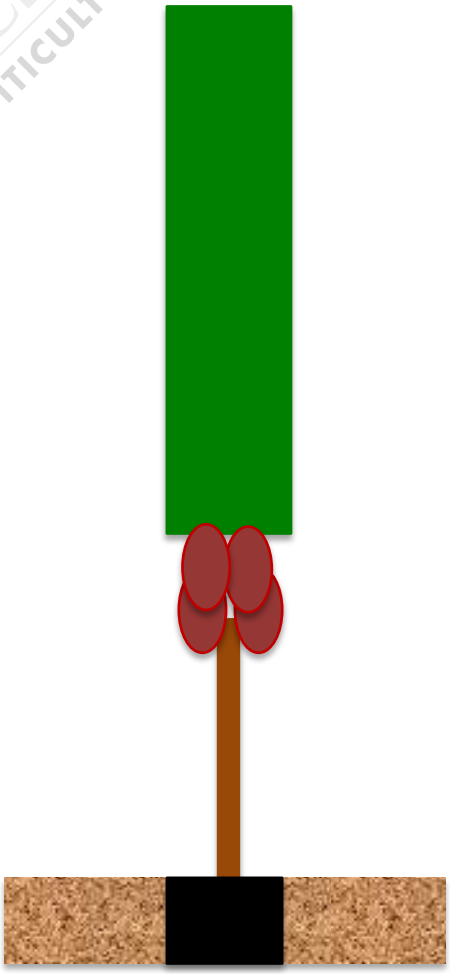
Sprinklers, misters

- Increase evaporation, reduce air temp
- Not trying to irrigate, only cool

Ground surface reflectance

Taller trellis systems

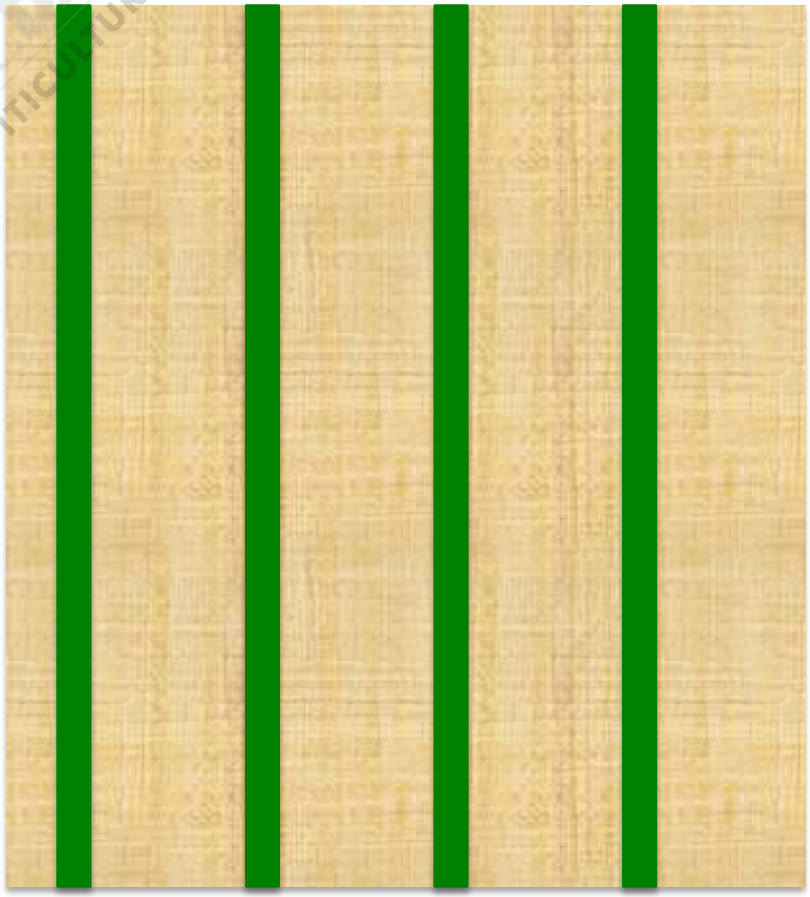
Row direction



A consideration on row direction

- If we orient VSP rows to maximize shading of the fruit at the hottest time of the day….
- ….aren't we also minimizing the amount of canopy exposed to direct sunlight….
- ….and maximizing the sun exposure on the row middle at this time?

What the sun sees, early afternoon

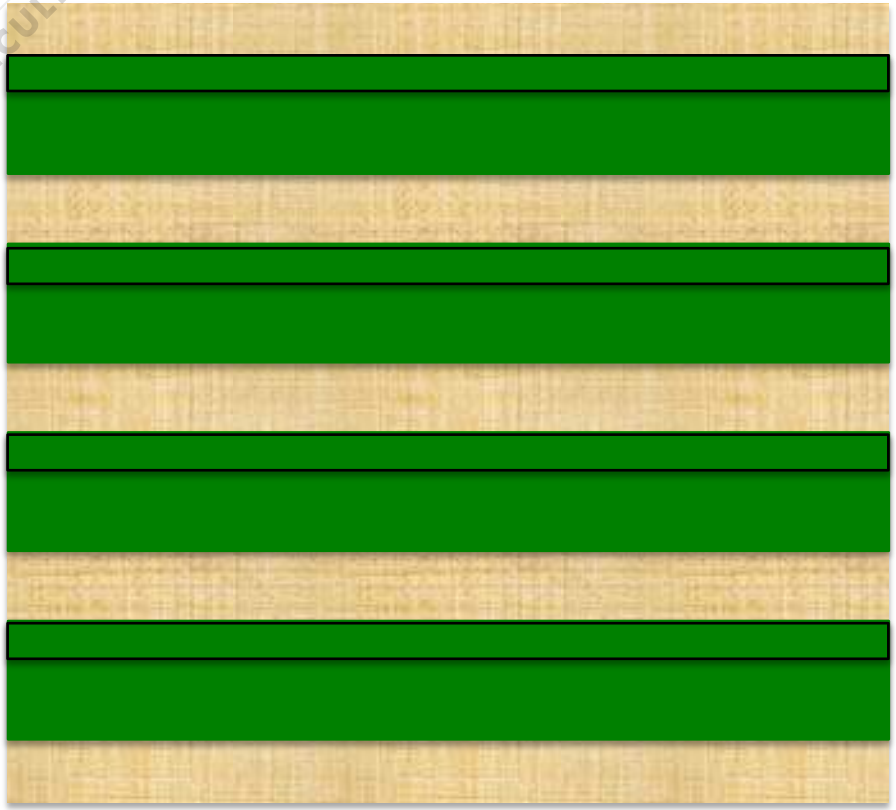


VSP on NE-SW rows

- Energy balance*:
  - LE minimized
  - H maximized
- Effect on air temperature within the vineyard?

* If no summer cover crop

What the sun sees, early afternoon



VSP on NW-SE rows

- Energy balance:
  - LE maximized
  - H minimized
- Effect on air temperature within the vineyard?

Spray materials

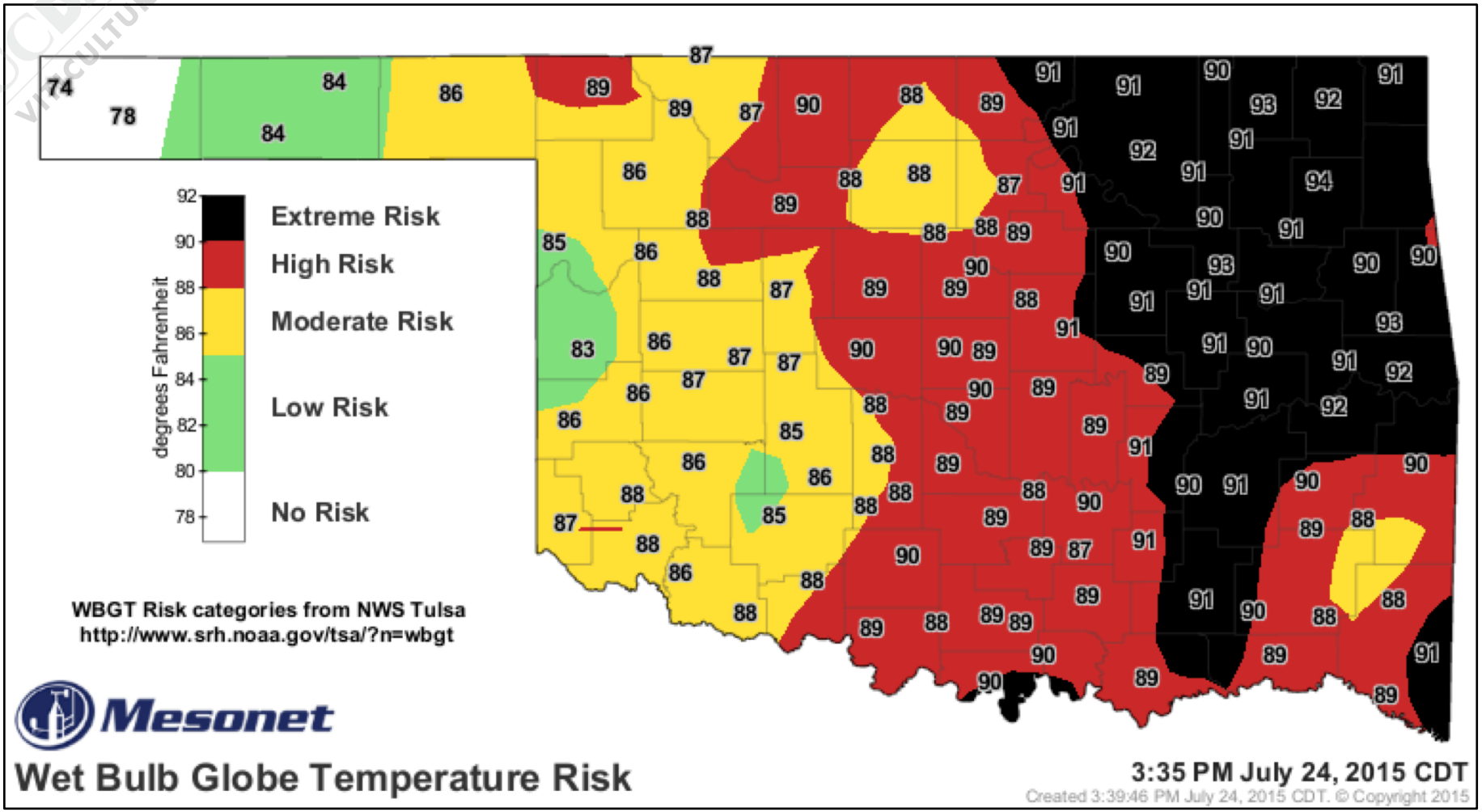
Shade cloth

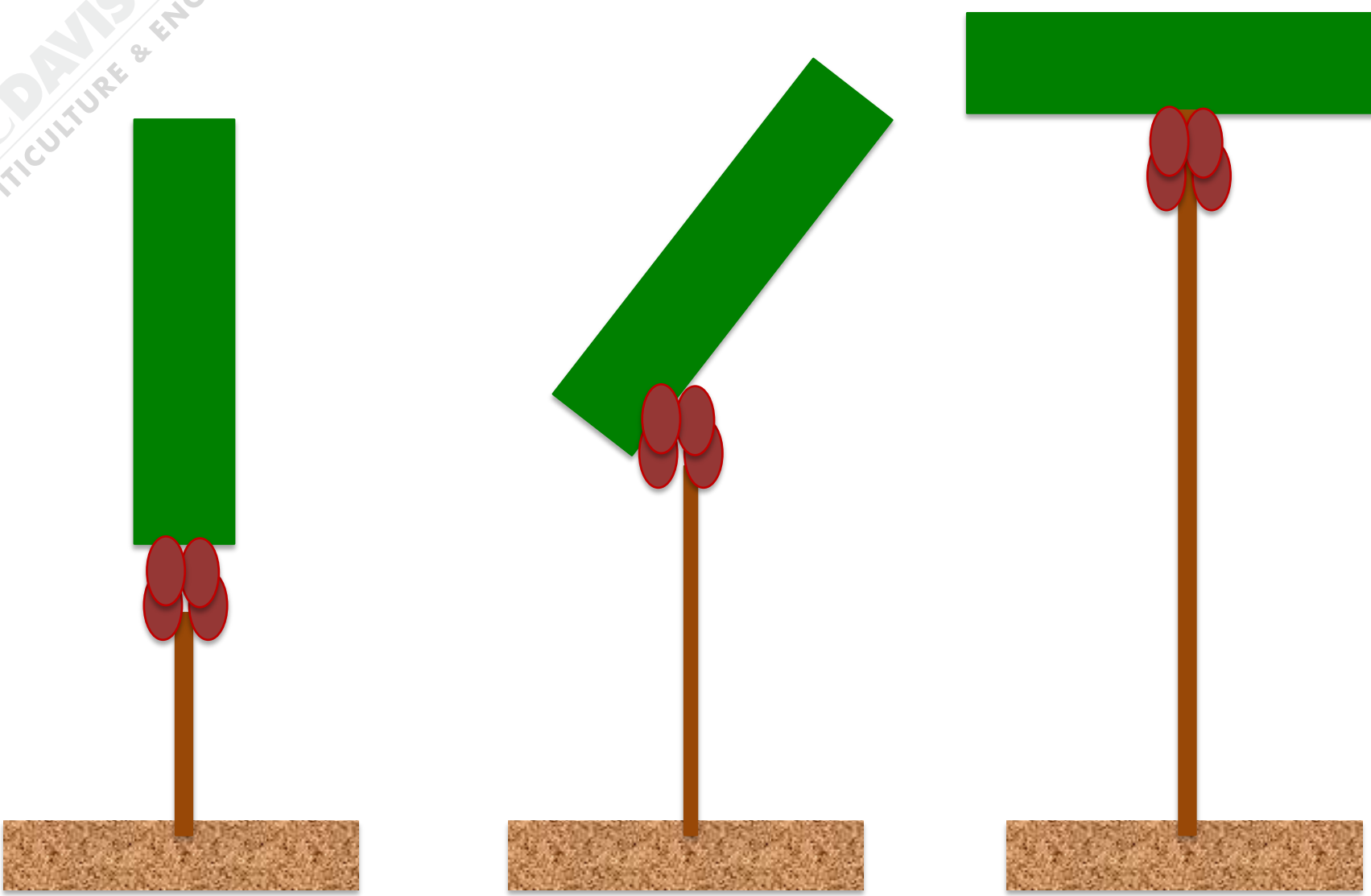
Improve information on heat stress

Wet bulb globe temperature

- Human heat stress index
- Integrates air temperature, humidity, wind, solar radiation
- Commonly used by military and sports teams
- Field worker safety

Wet bulb globe temperature






Hernan Vila – INTA Mendoza

Morphing VSP to Parral

- Incorporates many factors to reduce heat:
  - Tissues higher above ground surface
  - Greater proportion of incoming energy used to transpire water, less for heating surface
  - Greater proportion of leaves receive direct light
  - Shading of fruit, excellent ventilation of fruit