Monitoring Vine Water Status

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We have to be better than these guys…

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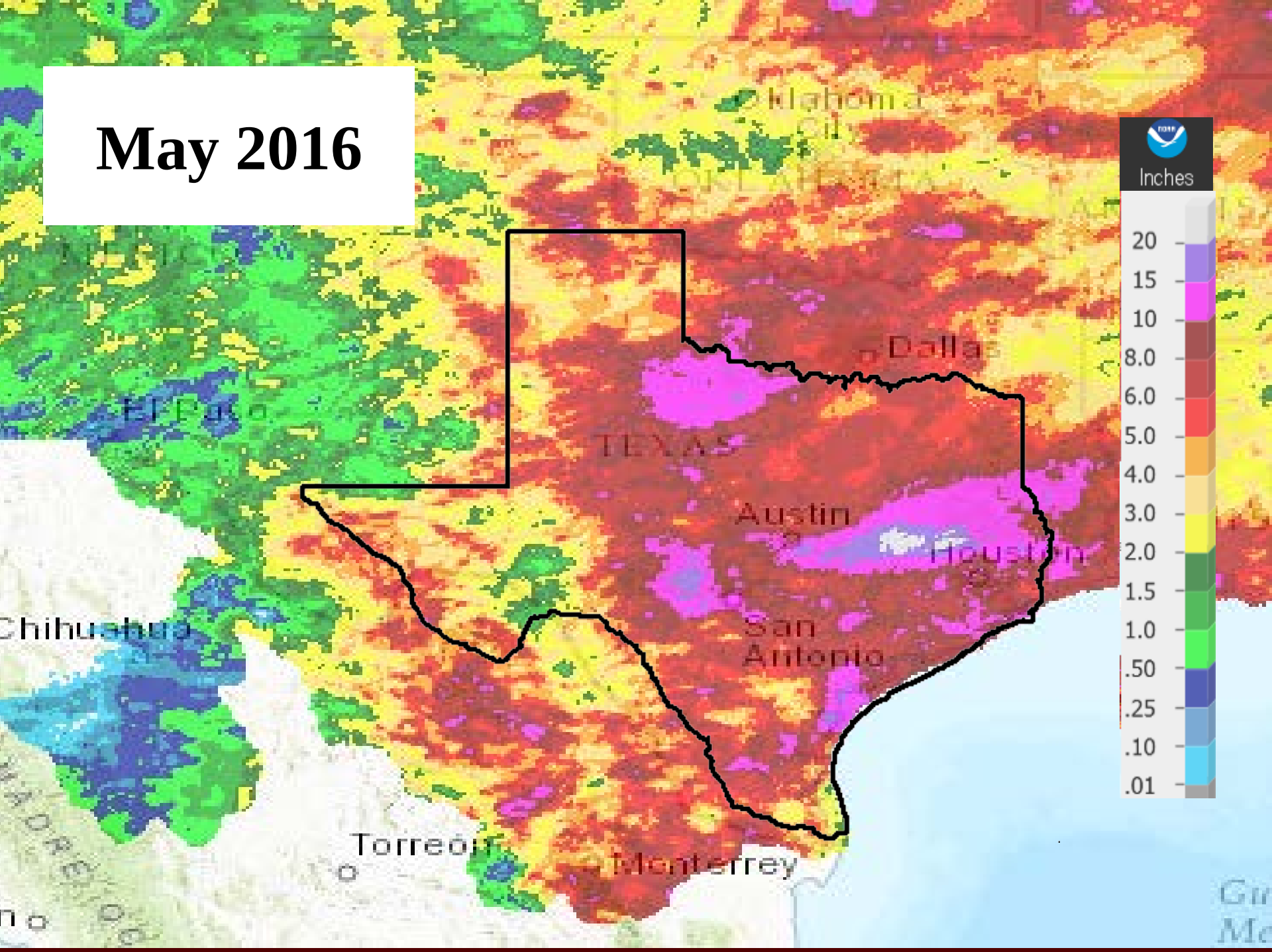

Inches
20
15
10
8.0
6.0
5.0
4.0
3.0
2.0
1.5
1.0
.50
.25
.10
.01
Dallas
TEXAS
Austin
Houston
San Antonio
Chihuahua
Torreon
Monterrey

Direct Vine Measurements

- Sight
- Feel
- Leaf temperature (infrared thermometer)
- Stomatal conductance (porometer)
- Water potential (pressure chamber)

Visual Symptoms of Drought Stress

Actively growing

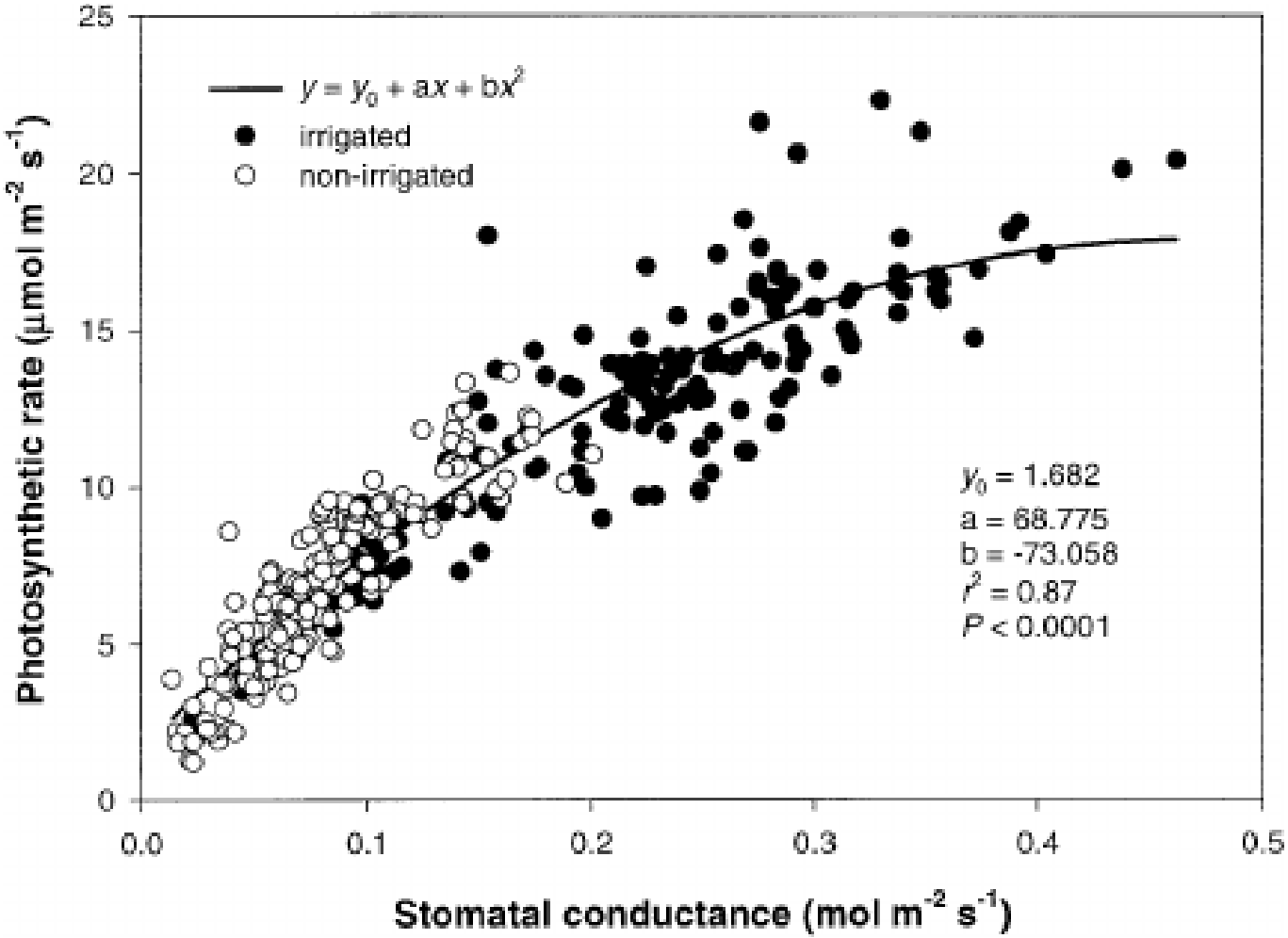
Not actively growing, not stressed

Stressed

Stressed

Leaves of drought stressed vines will often orient away from the sun.

Stomatal Conductance



Tognetti et al., 2004

Relative Sensitivity to Water Stress

Most Sensitive

shoot and leaf development

berry cell division

root growth

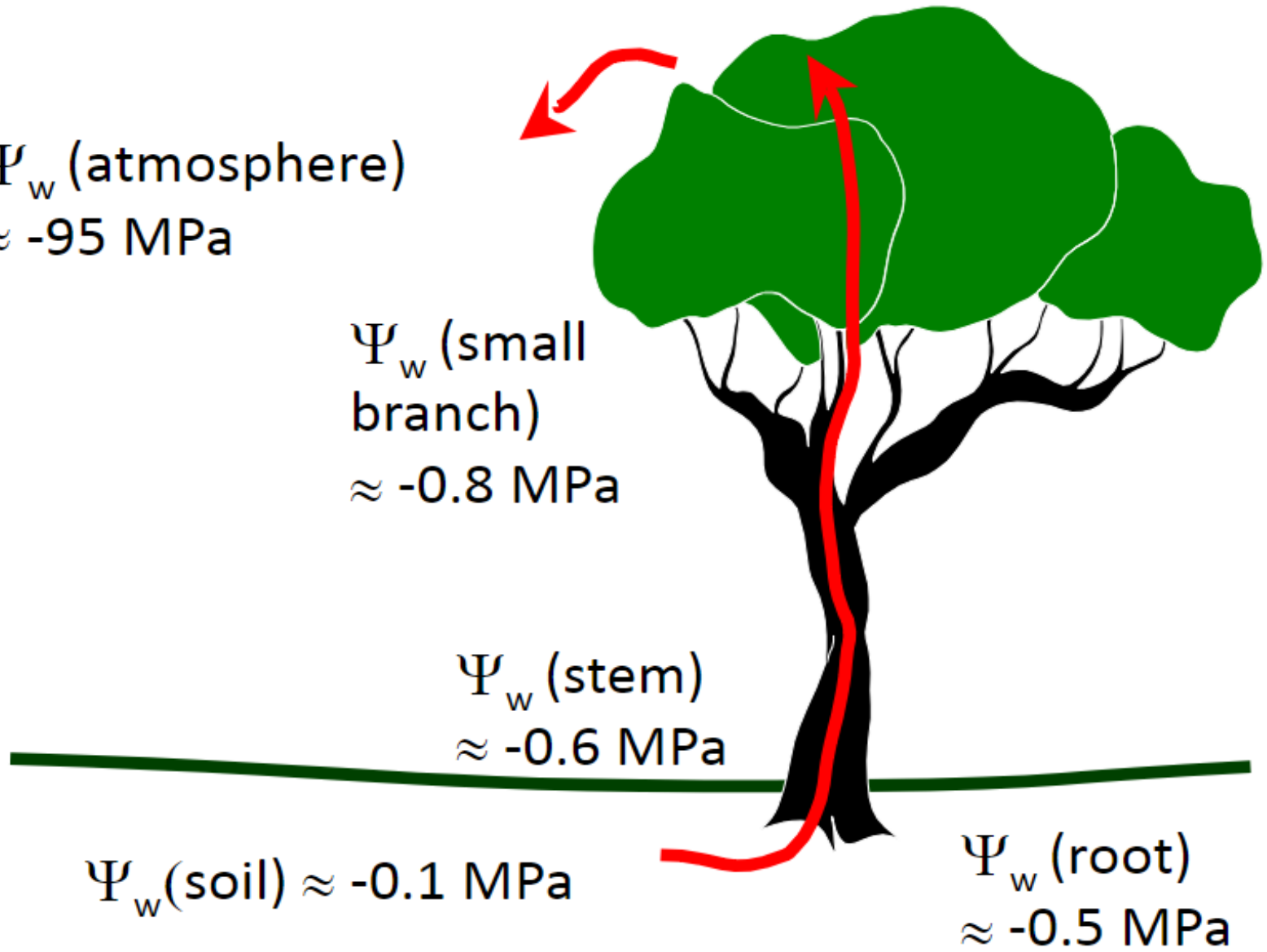
stomatal opening/photosynthesis

final berry sizing (pre-harvest)

Brix at harvest

Least Sensitive

The SPAC (soil-plant-atmosphere continuum)



Water Potential vs Photosynthesis

Ψ measurement (x)	Gas exchange (y)	Regression	r^2
Ψ_{PD}	A	y = 11.8 + 14.9x	0.67**
	g_s	y = 298 + 325x	0.69**
Ψ_l	A	y = 24.3 + 13.4x	0.50*
	g_s	y = 600 + 314x	0.58*
Ψ_{stem}	A	y = 19.3 + 12.4x	0.46*
	g_s	y = 485 + 293x	0.54*

*,**Significant at $P < 0.05$ or 0.01, respectively.

Williams and Araujo, 2002

Soil Water Content vs Water Potential

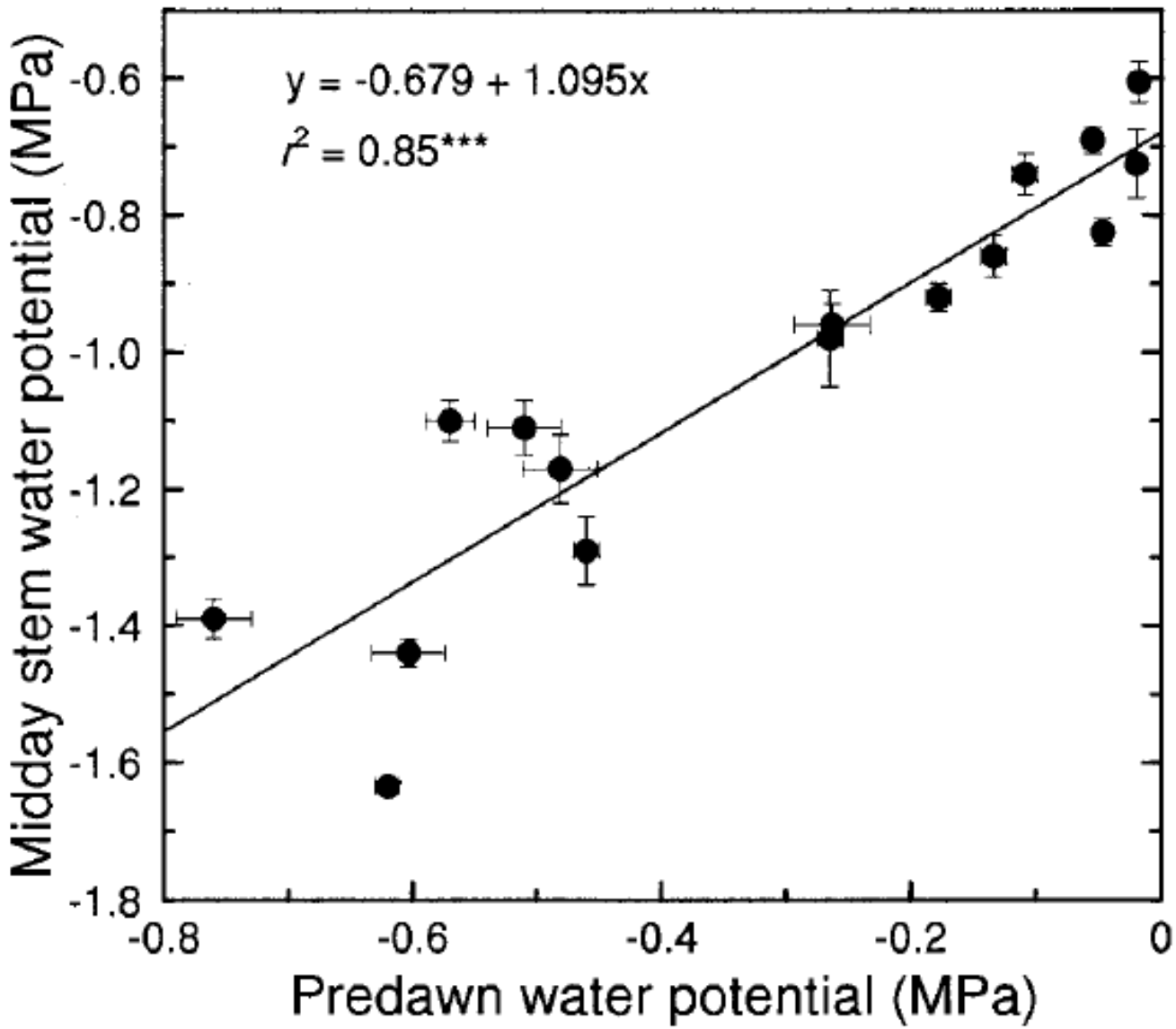
Ψ measurement	Regression	r^2
Predawn leaf (Ψ_{PD})	$y = -3.81 + 0.099x$	0.69^{**}
Midday leaf (Ψ_l)	$y = -5.86 + 0.129x$	0.68^{**}
Midday stem (Ψ_{stem})	$y = -5.77 + 0.134x$	0.63^{**}

**Significant at $P < 0.01$.

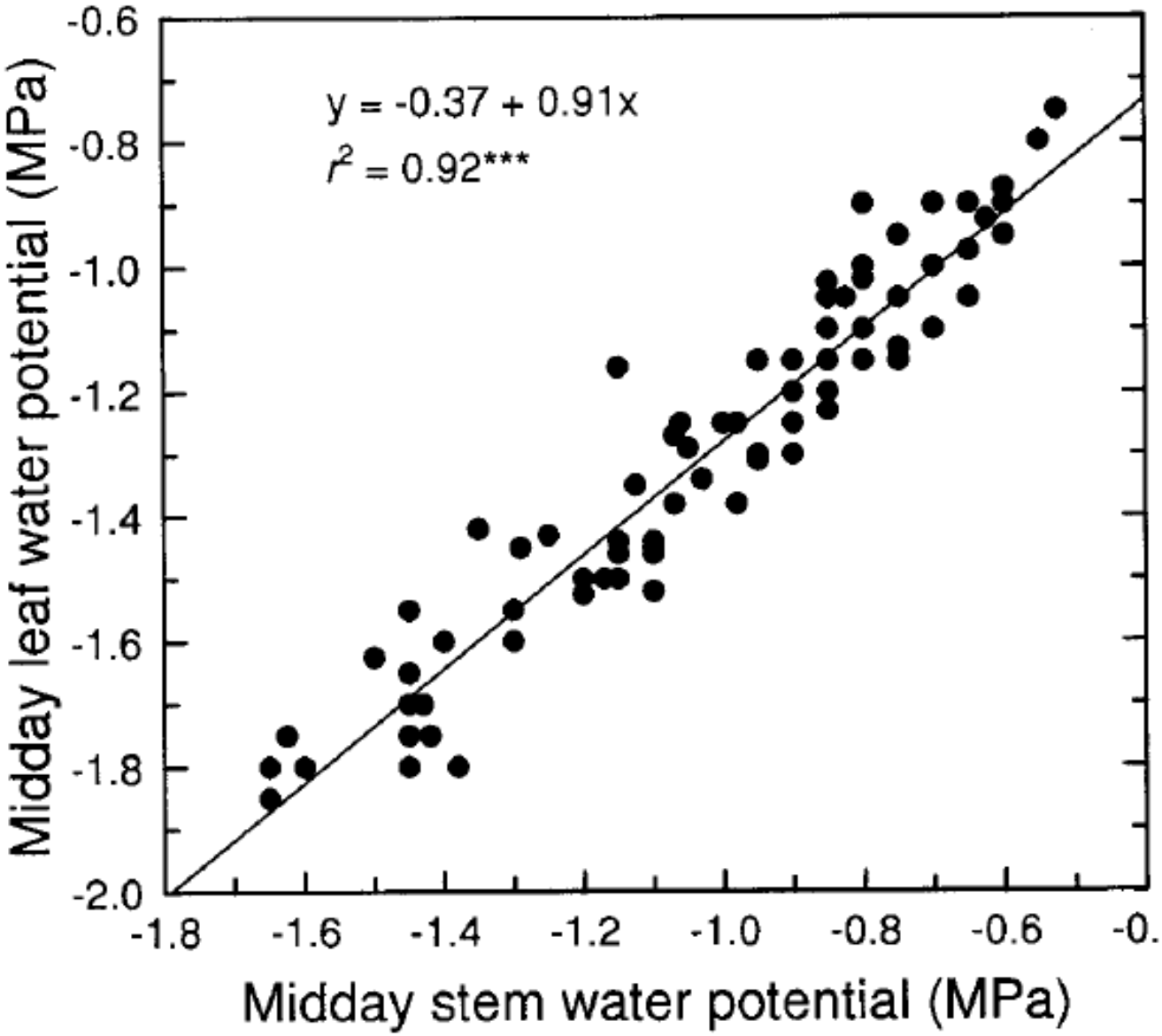
Williams and Araujo, 2002

Pressure Chamber

- Applies pressure with inert gas to an excised leaf or shoot enclosed in a chamber
- Pressure required to force water out at cut surface is inversely proportional to water in the tissue
- Reported as water potential



Williams and Araujo, 2002



Williams and Araujo, 2002

Pros and Cons of Pressure Chamber

Pros

- most direct measure of vine water potential
- can measure leaves, stems
- most plant processes well correlated to water potential; long research experience
- not excessively expensive or technical

Cons

- manual so limited numbers of measures can be taken
- during the day water potential varies with time and weather so comparison of readings may be difficult
- time consuming

Questions?