Irrigation scheduling and cotton productivity during the drought

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Is different scheduling required for BollgardII?

- **Holy Grail – higher yields while capturing more in crop rainfall!**

- **Bollgard II Varieties: smaller, high retention with high yield potential, but sensitive to water stress at late in flowering.**

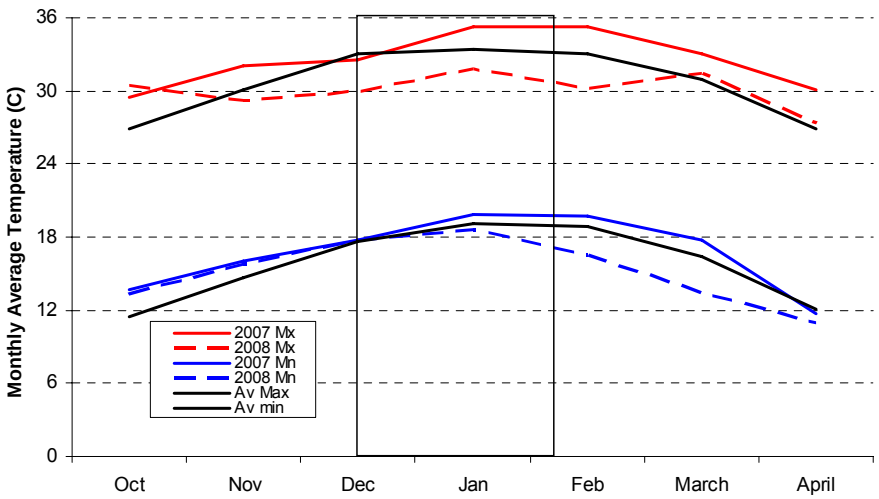
- **Late 1970's scheduling at 50% of plant available water maximised yield. That is a 100mm deficit where 200 mm is available!**

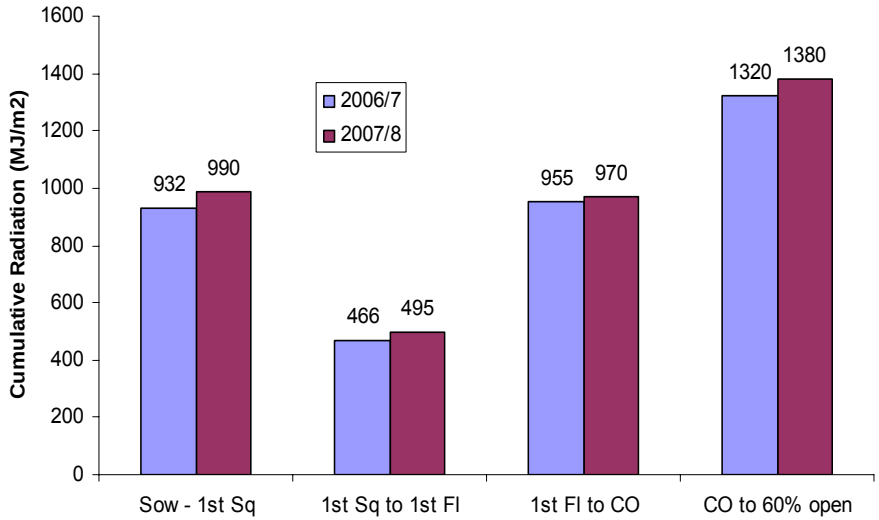
- **Should scheduling combine plant stress and water availability?**

Understanding the response to water

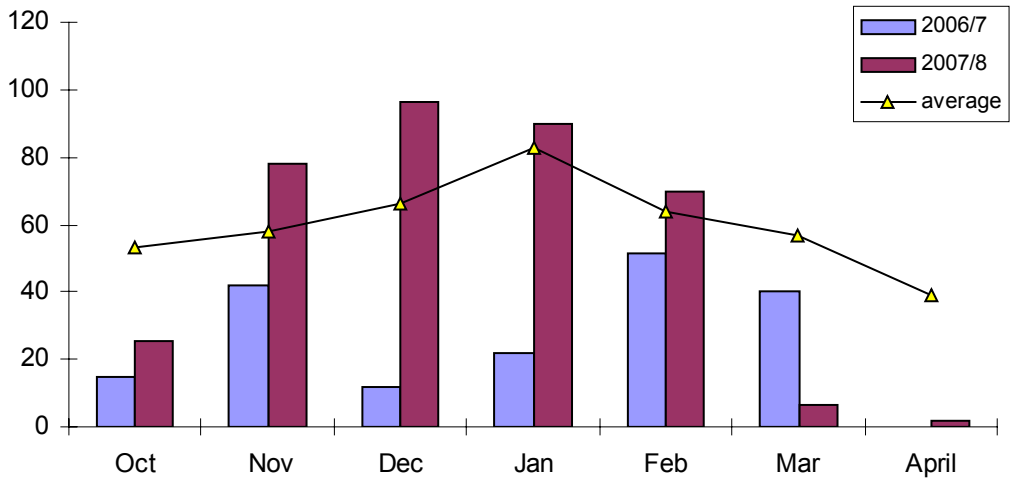
Two different seasons

Temperature and Radiation





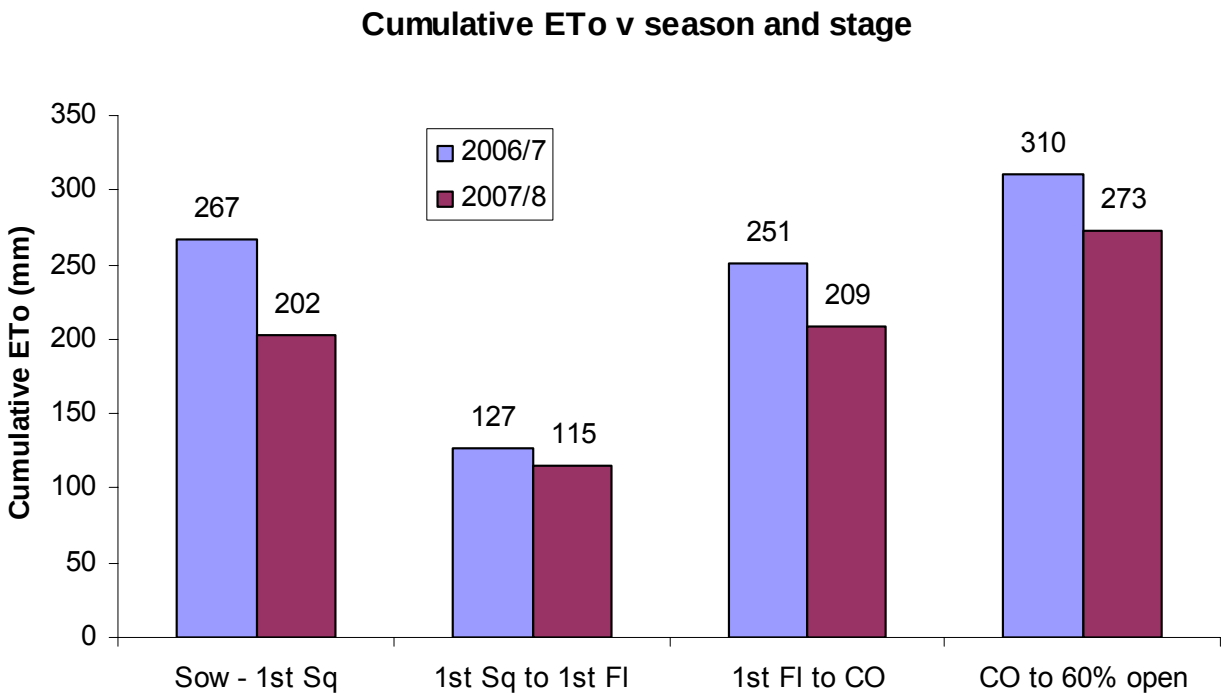
In Crop Rainfall



Total In-crop Rain

2006/7 = 171 mm 2007/8 = 368 mm

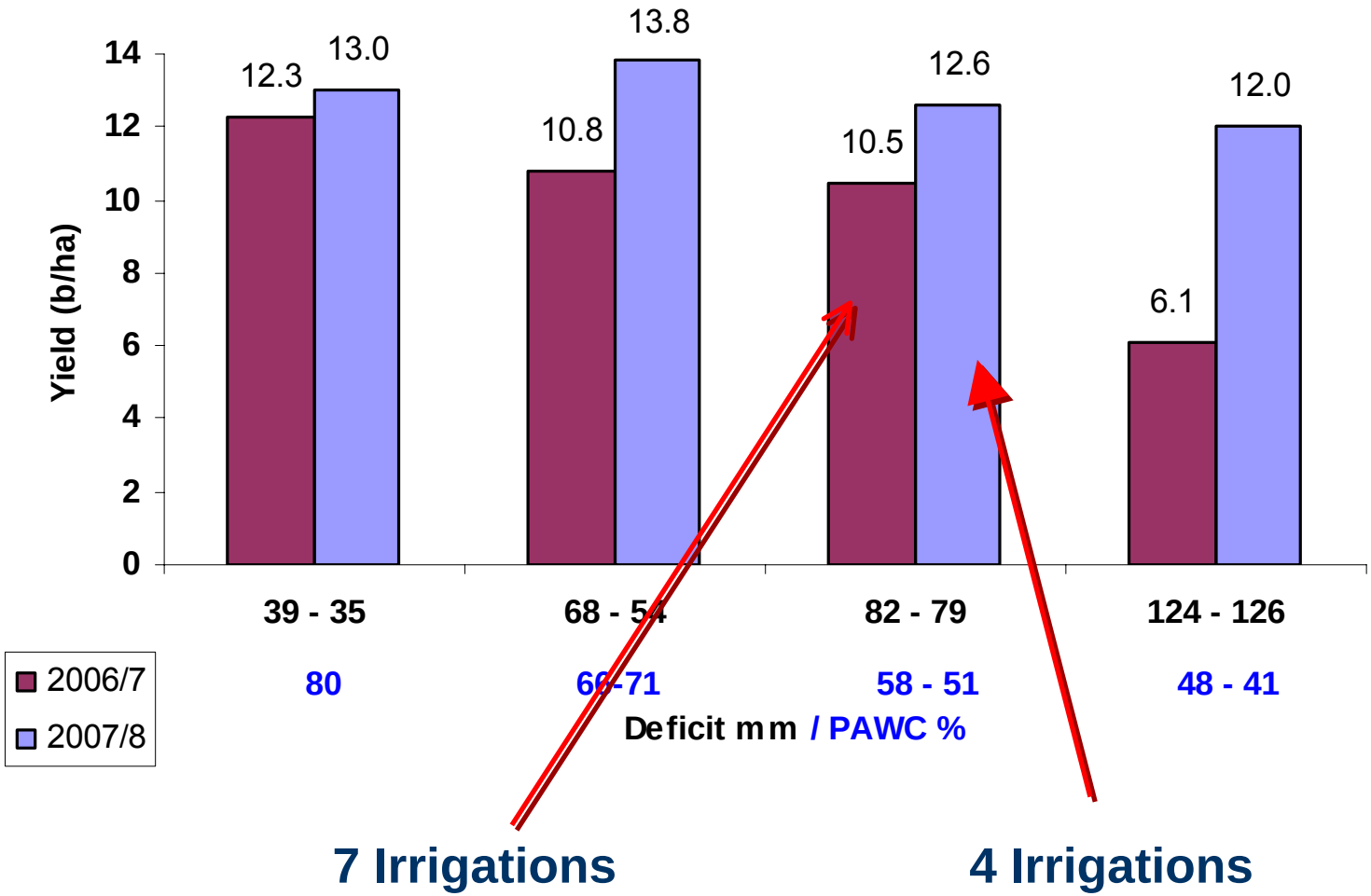
Evaporative Demand



Season Total ETo

0607 = 955 mm 0708 = 799 mm

The effect of season and deficit on lint yield

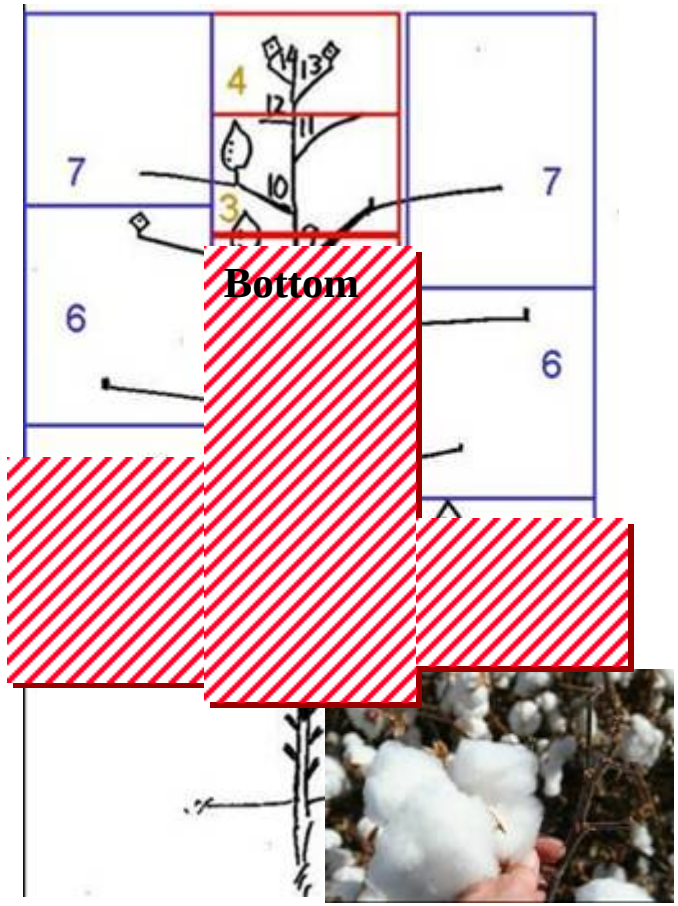


How was yield achieved?

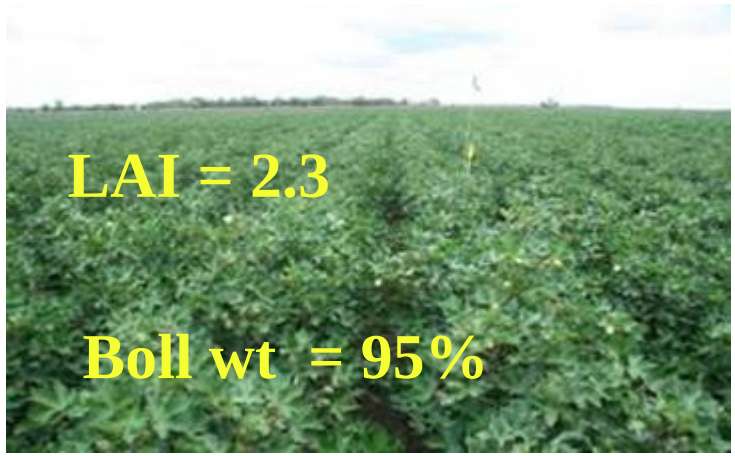
The effect of moisture availability was to change the contribution of the 'Top' bolls.

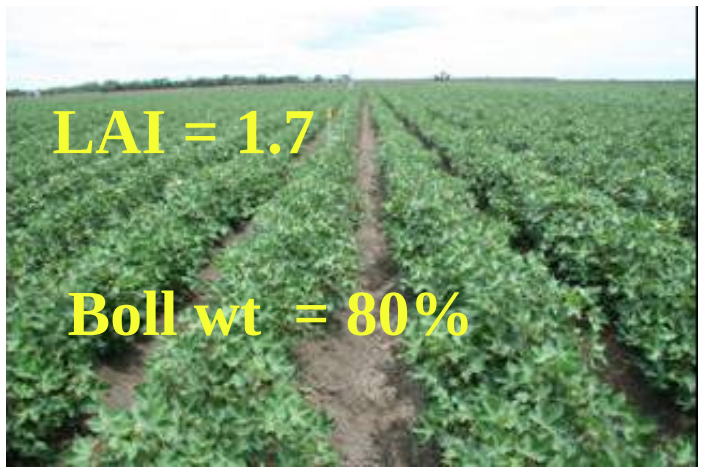
•Having less moisture stress during flowering permitted more 'Top' fruiting fruiting sites to grow.

Deficit	PAWC	2006/7 Bottom	2006/7 Top	2007/8 Bottom	2007/8 Top
39 - 35	0.8	6.3	6.0	5.7	7.3
68 - 54	0.68	6.3	4.4	6.4	7.4
82 - 78	0.55	6.3	4.2	5.9	6.7
124 - 126	0.45	4.3	1.8	6.2	5.8



Using water availability to balance growth
2006/7





Water volumes applied

- **We found the irrigation application efficiency increased with deficit.**
- **Water requirement is very dependent on individual farm's delivery capacity and efficiency.**
  - Is frequent irrigation possible in a full production year?
  - Does application efficiency change with deficit?
  - **How efficiently is your tail water returned?**

Deficit mm	Irrigation Efficiency
39 - 35	0.60
68 - 54	0.70
82 - 78	0.70
124 - 126	0.85

Fibre Quality

Season	Deficit	Length	Strength	Micronaire
2006/7	39	1.17	30.6	4.98
	68	1.15	29.7	5.18
	82	1.16	29.6	5.38
	124	1.11	28.6	5.60
	lsd	0.022	1.45	0.198
2007/8	35	1.20 (1.17)	29.5 (28.7)	4.0 (4.4)
	54	1.21 (1.17)	29.9 (29.5)	3.7 (3.9)
	79	1.22	30.3	3.9
	126	1.20	30.1	4.1
	lsd	0.023	1.01	0.199

Conclusions

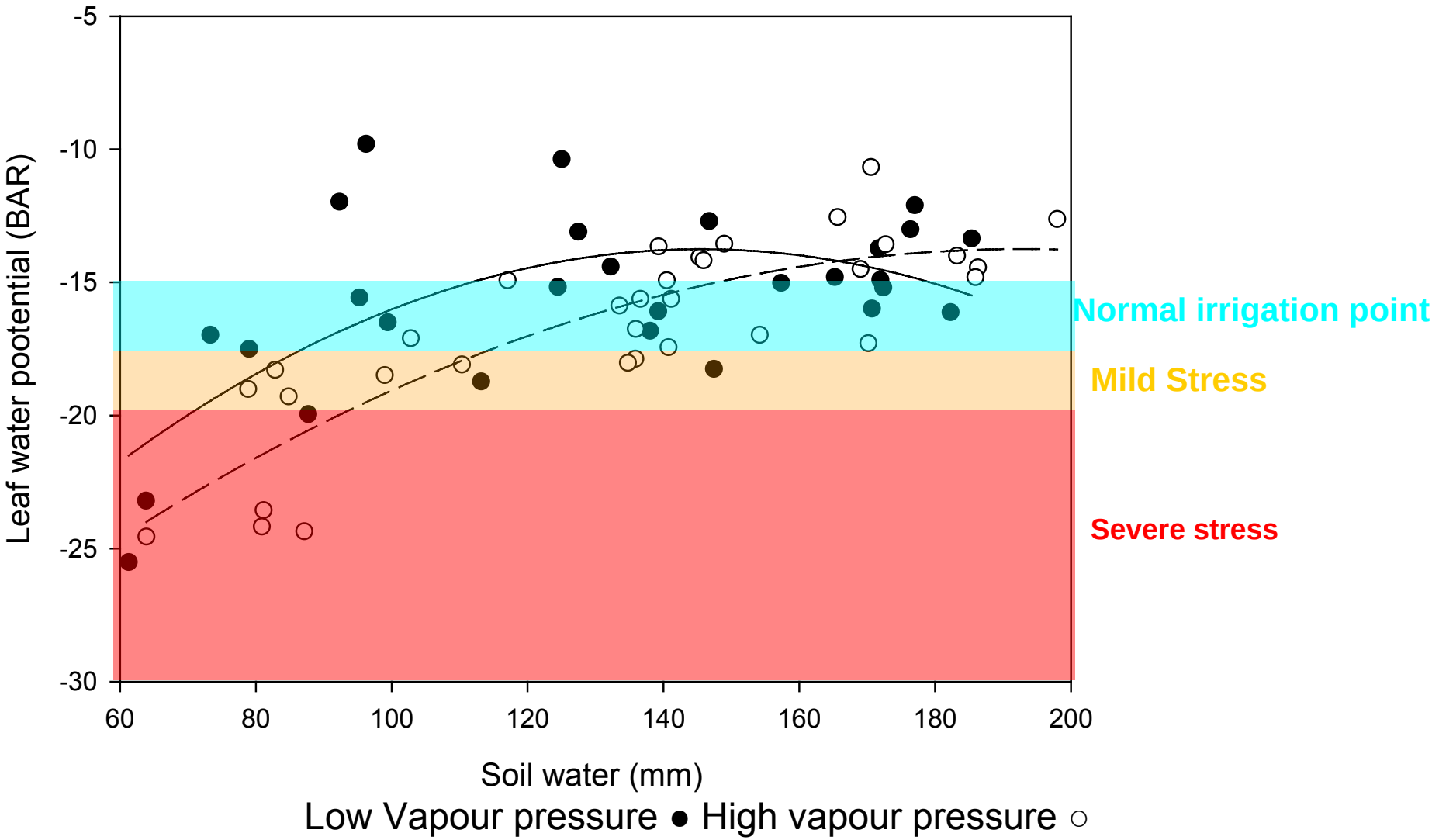
The optimal soil water deficit for yield was between 35 and 60mm and was changed by evaporative demand and seasonal climate.

Varying the deficit could be a management option to produce balanced growth.

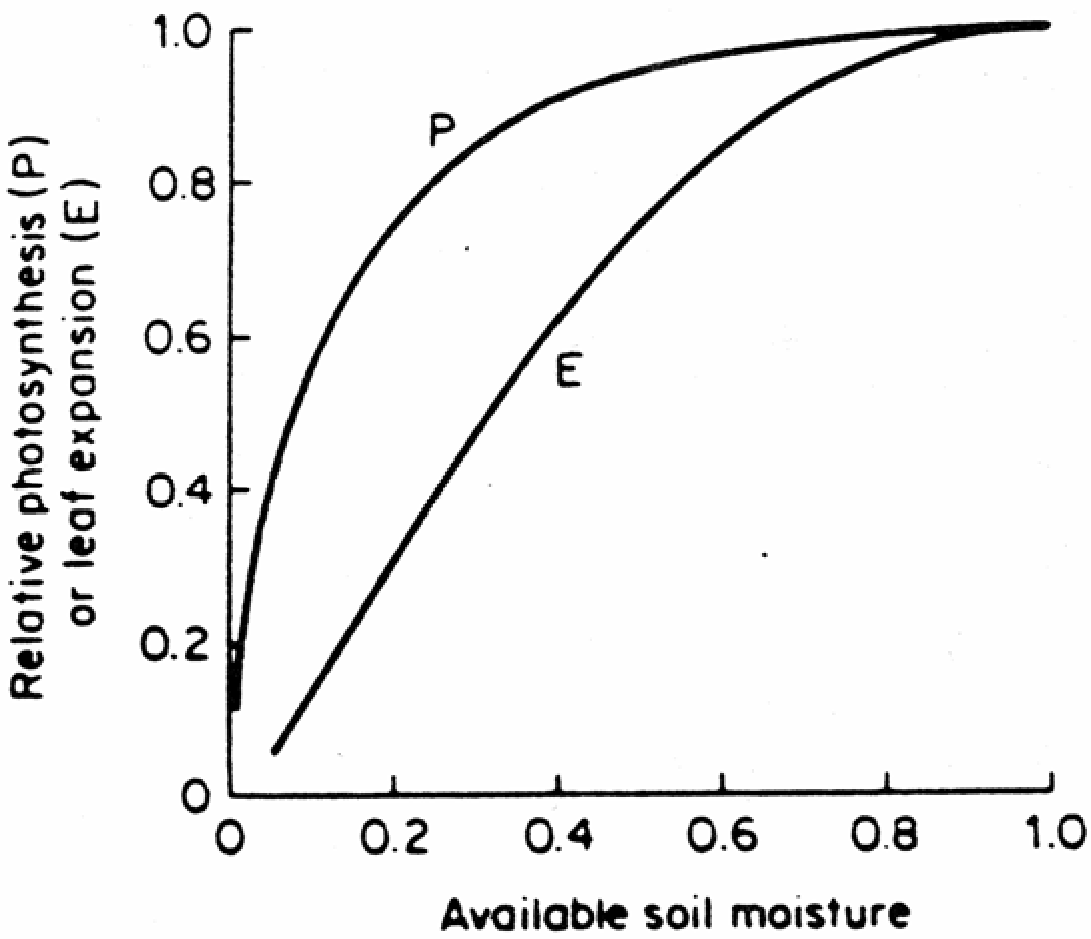
A measure of plant stress in conjunction with soil water could enhance water use efficiency.

That is when plant stress is lower less use larger deficits that can capture more rainfall.

Plant response to climate

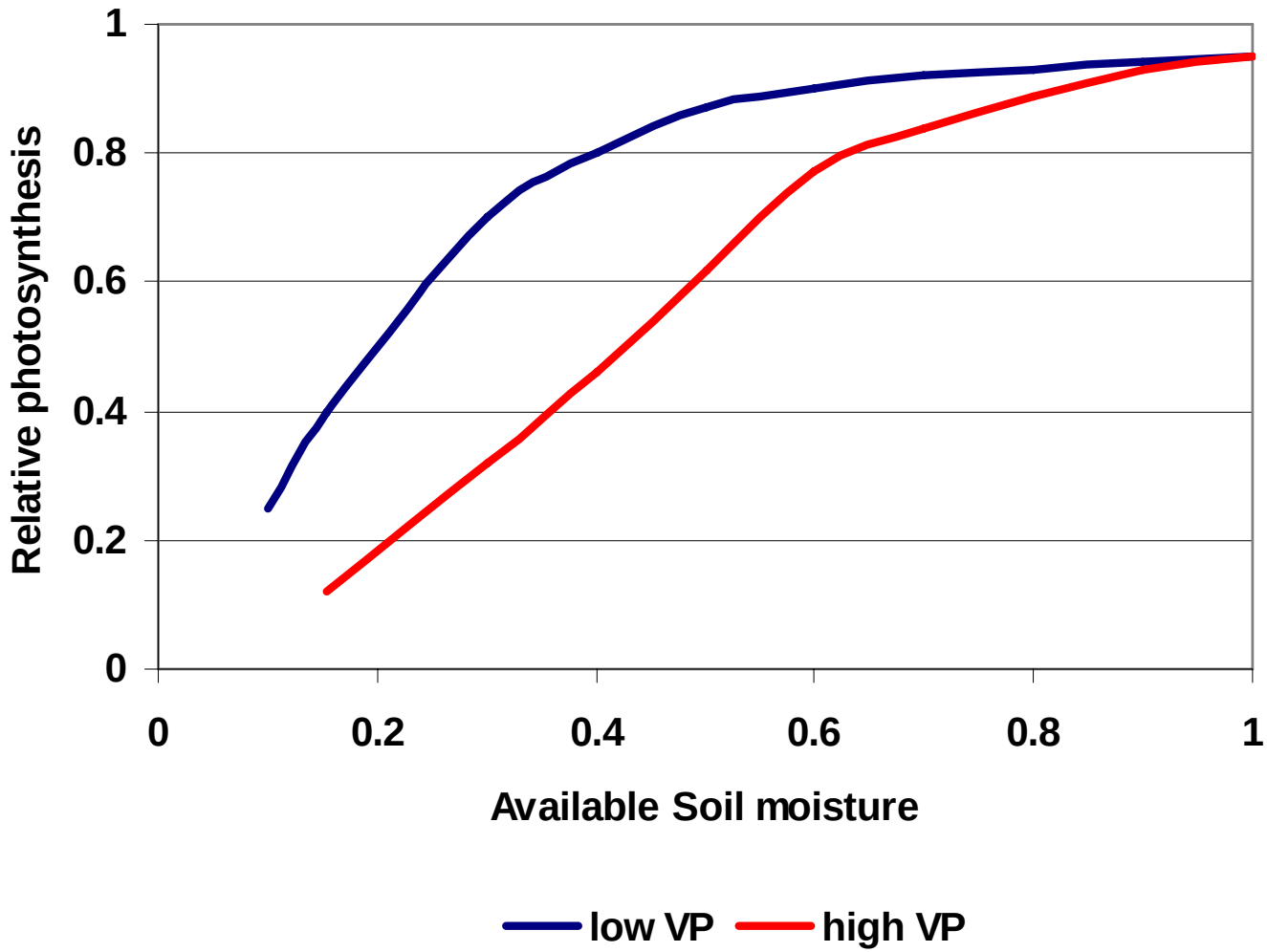


Plant response to water stress



Constable 1980

Climate effect on photosynthesis



Implications for irrigation

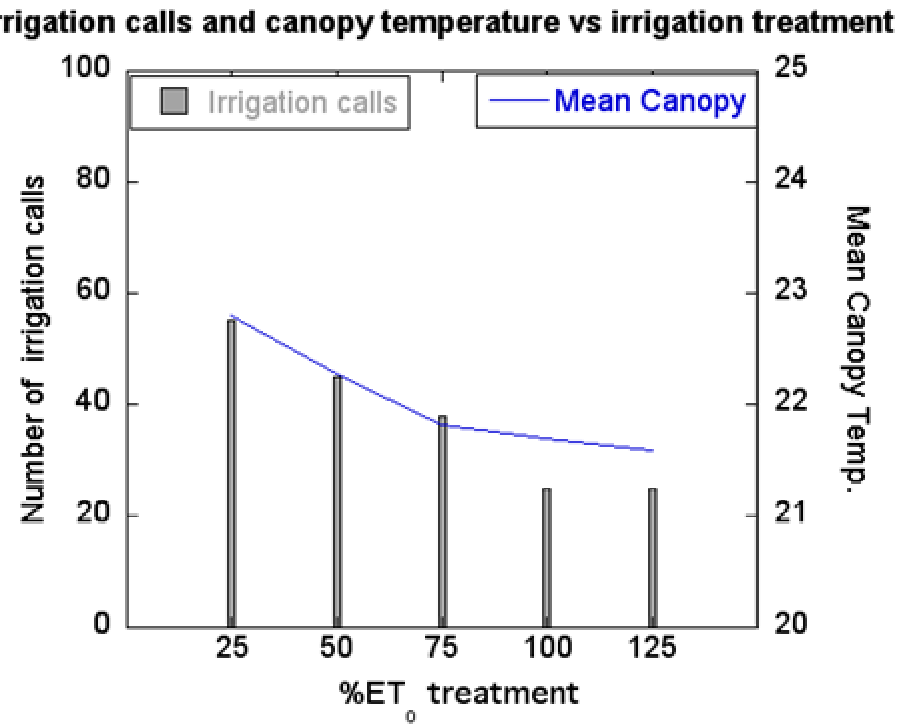
Changes in evaporative demand affected the level of plant stress regardless of the soil moisture

Irrigation scheduling may need to take evaporative demand into account and adjust the soil moisture deficit you irrigate at, not just the frequency of irrigation

Important when future climate change predictions suggest increased evaporative demand.

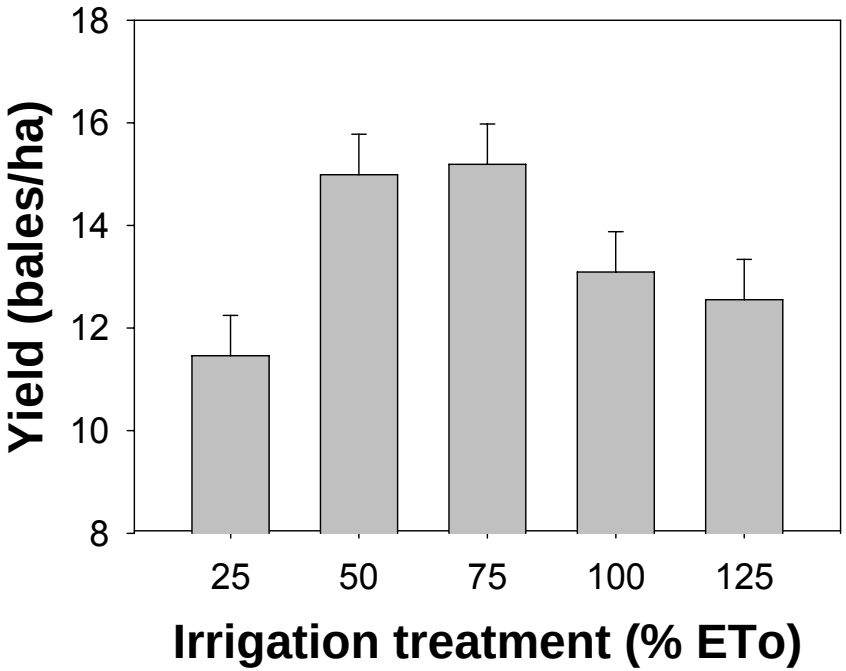
Method of integration?
SmartCrop™ infrared sensors– cheap, portable, telemetry

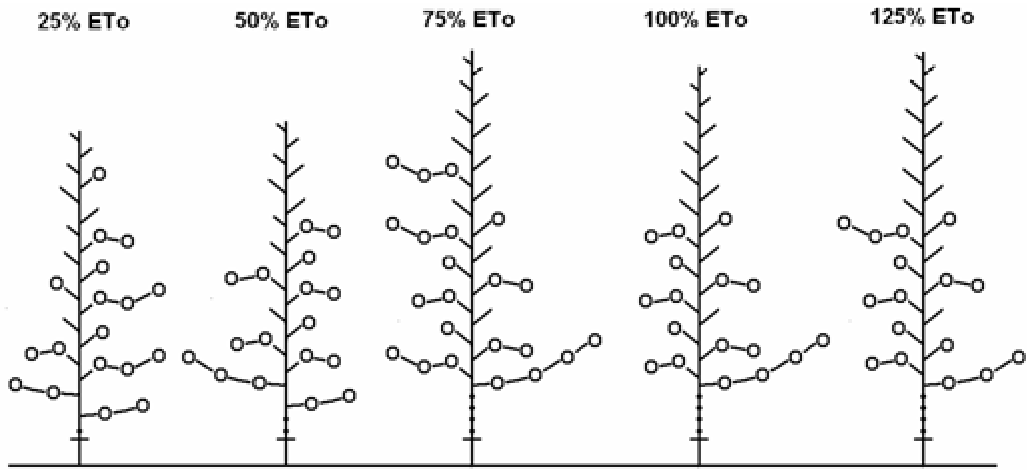
Warren Conaty



Currently working with drip irrigation, expanding research to include furrow and overhead

SmartCrop™ yields and partitioning





Other modifications for drought

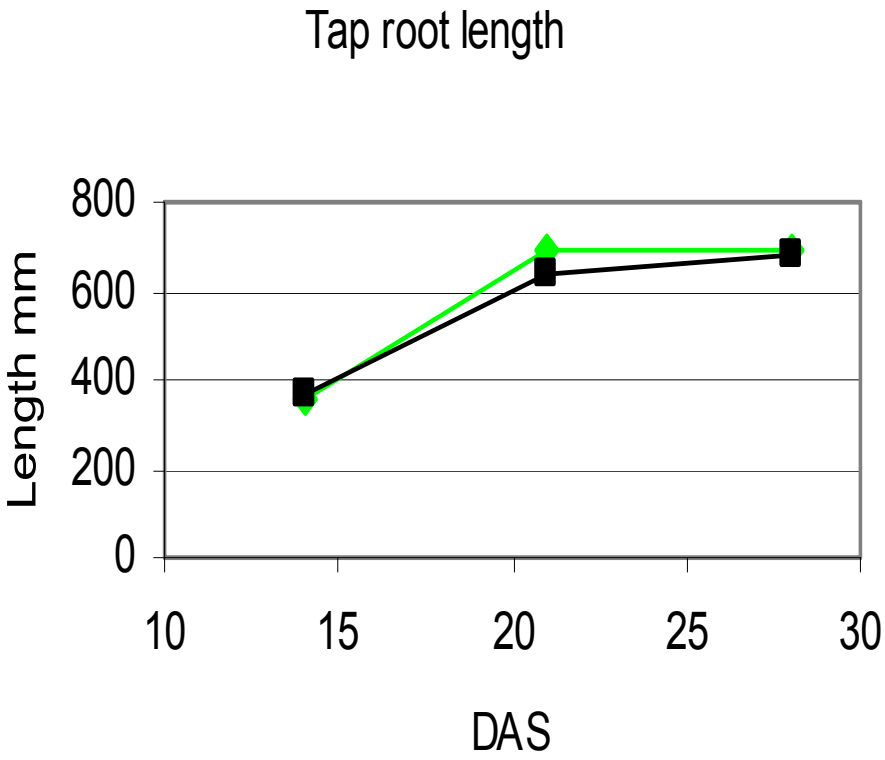
Increased focus on alternate crop configurations

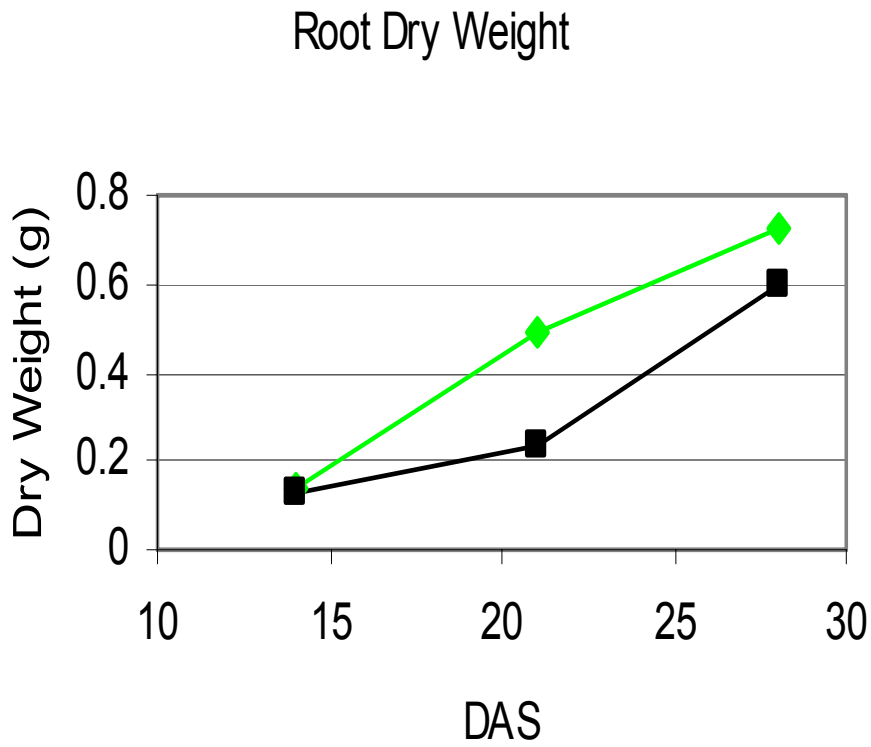
Need to explore the soil to access the extra water

Investigate genetic differences in the root development of cotton varieties

Potential to reduce irrigation requirements

Early season root development





Siokra 24 B ♦ Sicot 71 B ■

Neilsen and Stiller, CBA 2008