

# Climatic effects on Citrus Phenology and Production

**Dr Tahir Khurshid**

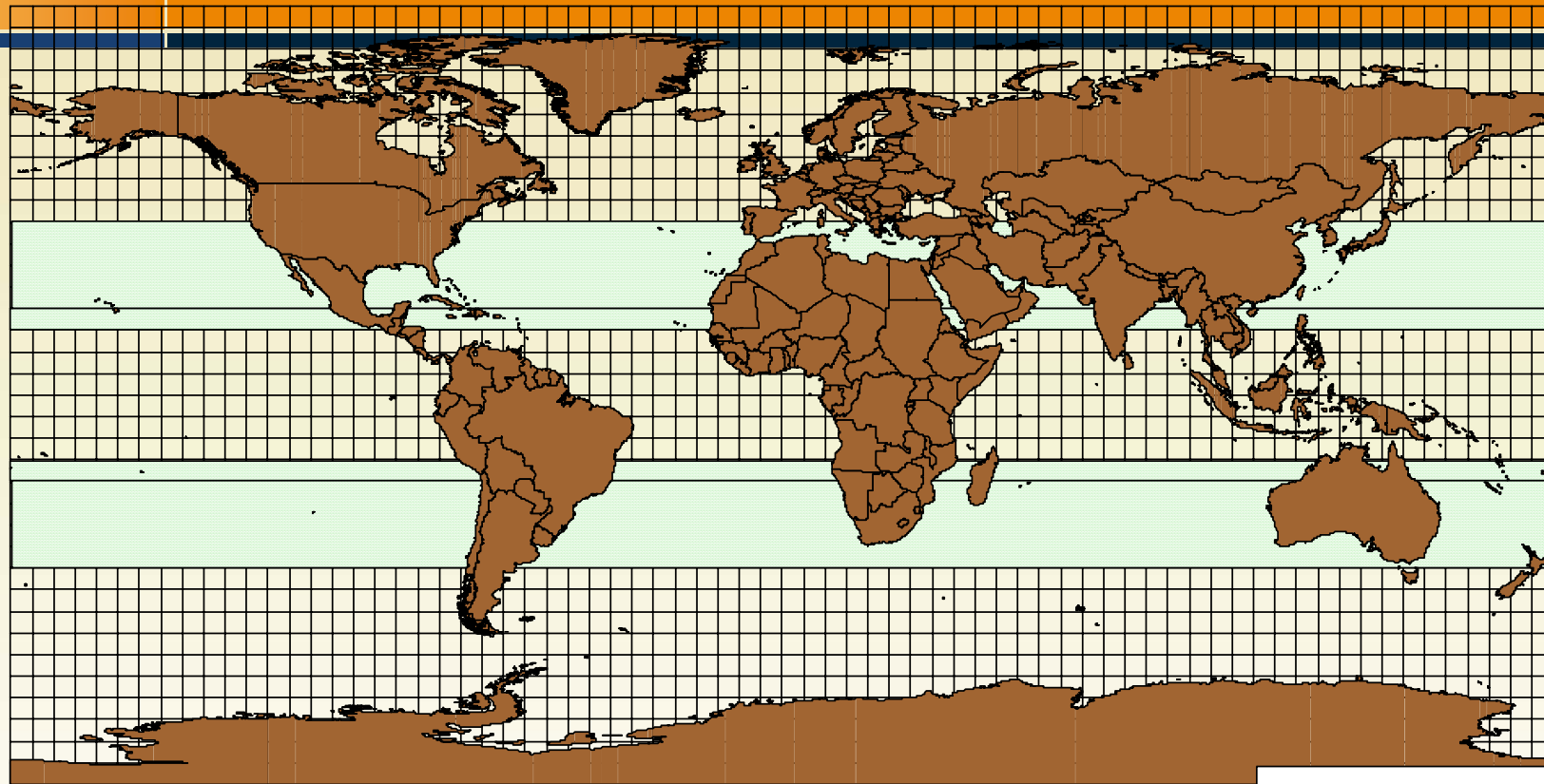
**Agriculture Research & Advisory Station  
Centre of Excellence in Irrigated Horticulture**

**Dareton**



**NSW DEPARTMENT OF PRIMARY INDUSTRIES**

# World Citrus Growing Latitudes




40°  
20°  
40°  
20°



5000 0 5000 10000 Kilometers

## Legend

-  Country
-  Citrus Growing Latitudes

# World citrus production countries



# Australia and New Zealand



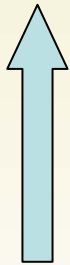
# Heat Units

$$\left( \frac{\text{Max temp} + \text{Min temp}}{2} \right) - \text{base temp}$$

– base temp



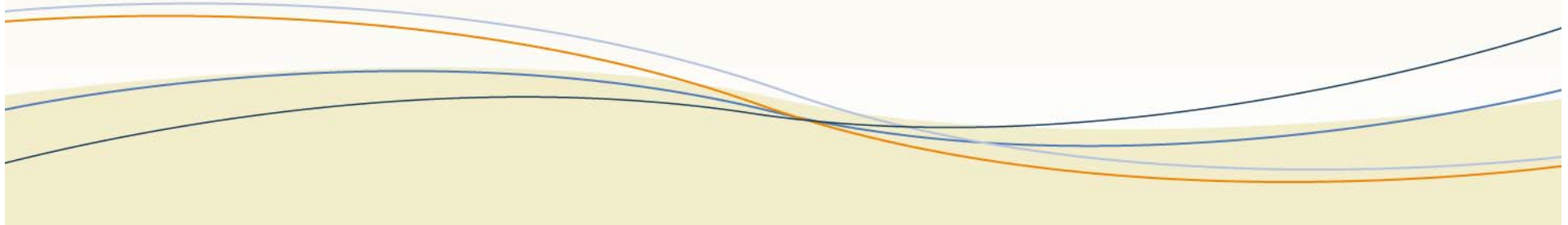
threshold = 35 °C



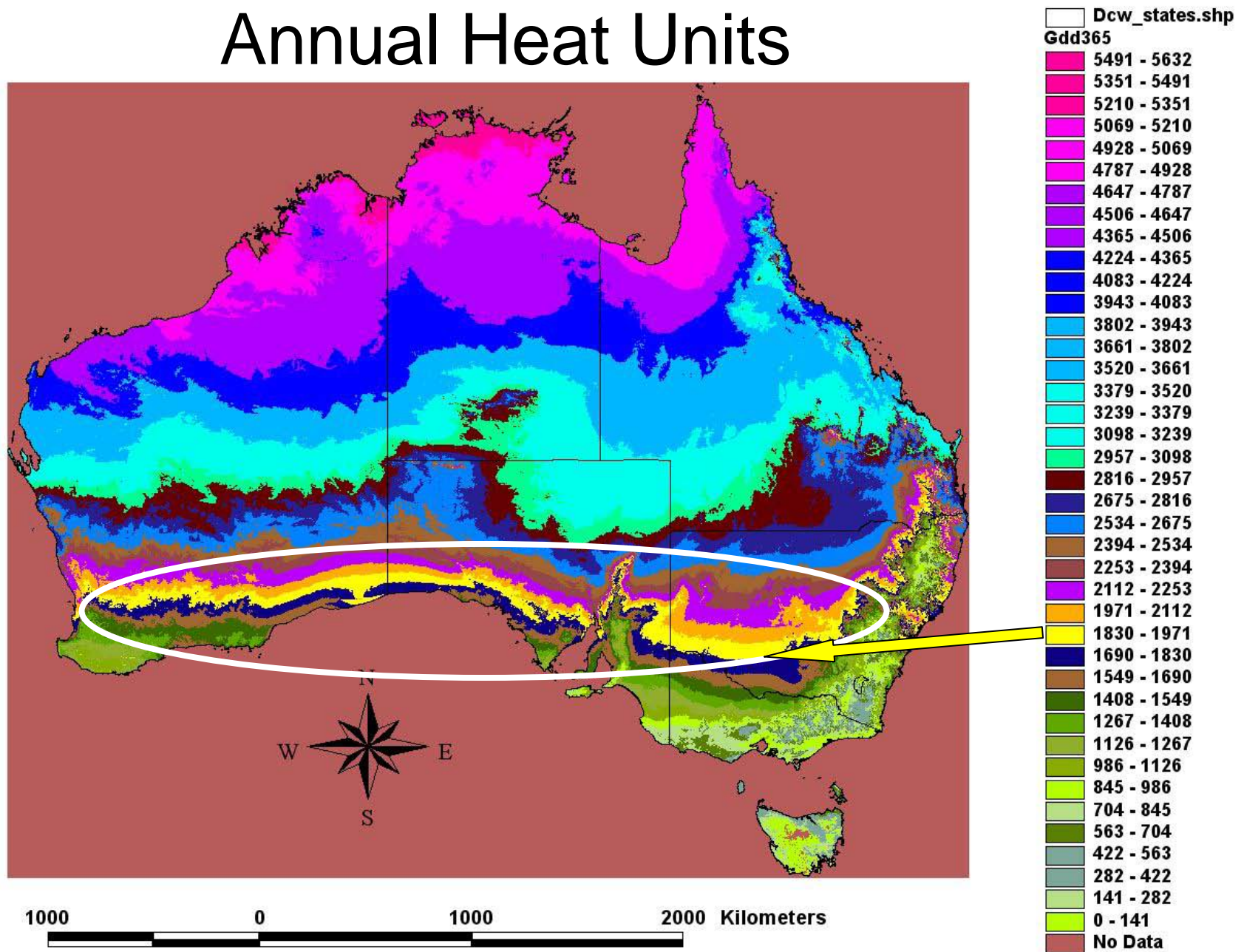
threshold = 2 °C



13 °C



# Annual Heat Units



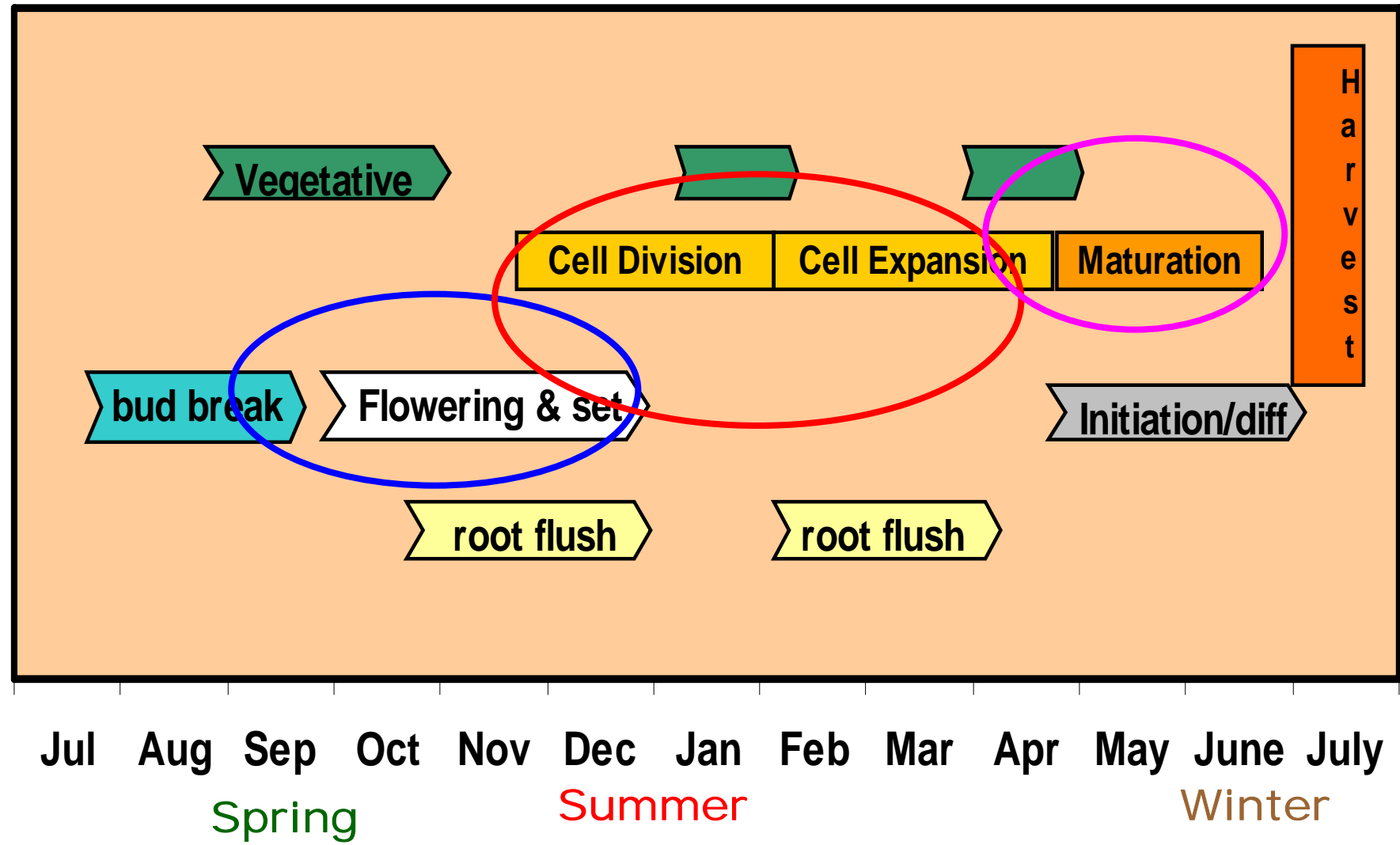
# Phenology?

## Importance of phenology

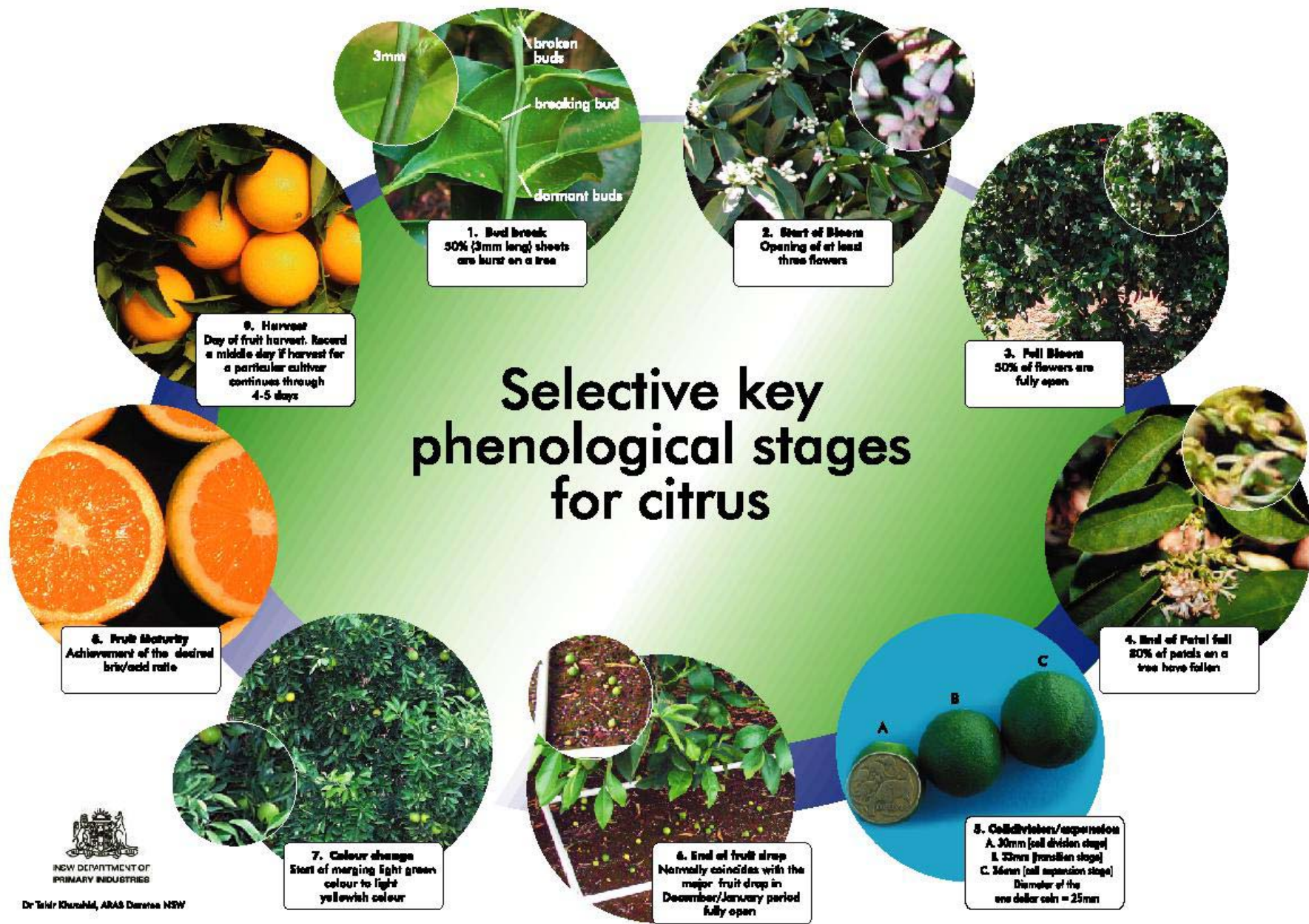
### Factors affecting phenological stages

- Tree
- Soil
- Rootstock
- Cultivars
- **Climatic (Temp. / Rain)**

# Citrus Phenological Cycle



# Selective key phenological stages for citrus



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# Flowering

First flower open

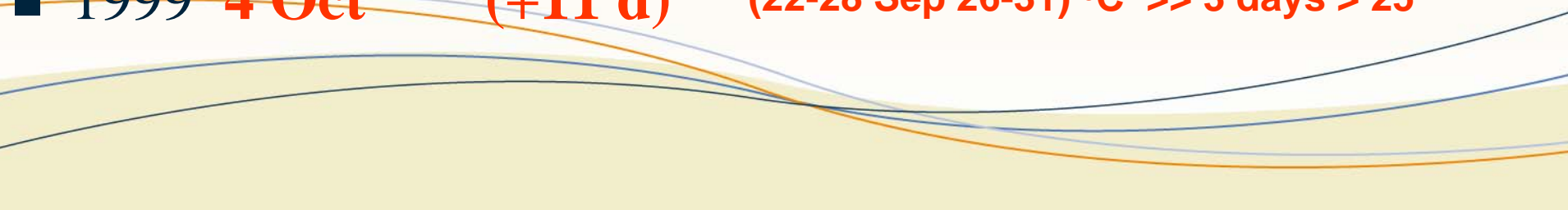


Full bloom



## Full Bloom dates at Dareton for Washington Navel

Average Full bloom- 15 Oct

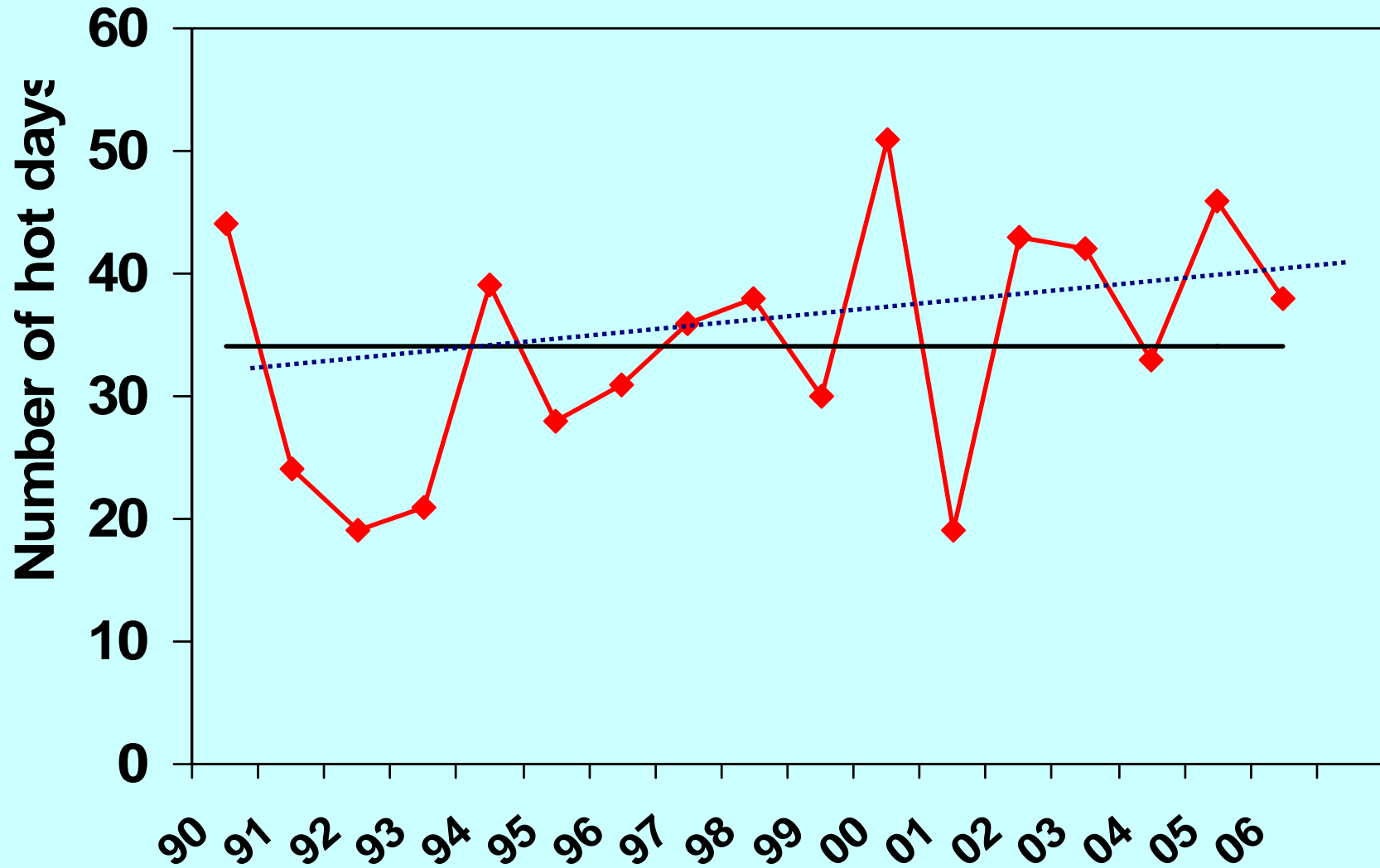
- 2006 **1 Oct (+14 d)** (14-19 Sep 27-33 °C) >> 3 days >27
  - 2005 13 Oct (+2 d)
  - 2004 6 Oct (+9 d)
  - 2003 14 Oct (+1 d)
  - 2002 10 Oct (+5 d)
  - 2001 8 Oct (+7 d)
  - 2000 11 Oct (+4 d)
  - 1999 **4 Oct (+11 d)** (22-28 Sep 26-31) °C >> 3 days > 25
- 

## Average Fruit diameter (mm)

|           | 6/12/04 |     | 6/12/06 |     | Full Bloom |
|-----------|---------|-----|---------|-----|------------|
| Navelina  | 24      | 10% | 31      | 90% | +8 d       |
| W Navel   | 28      | 80% | 32      | 95% | +14 d      |
| Barnfield | 24      | 0%  | 29      | 55% | +11 d      |

Fruit size is advanced by 12 days

## No of days $>35^{\circ}\text{C}$ (Nov-Mar)



# Fruit set

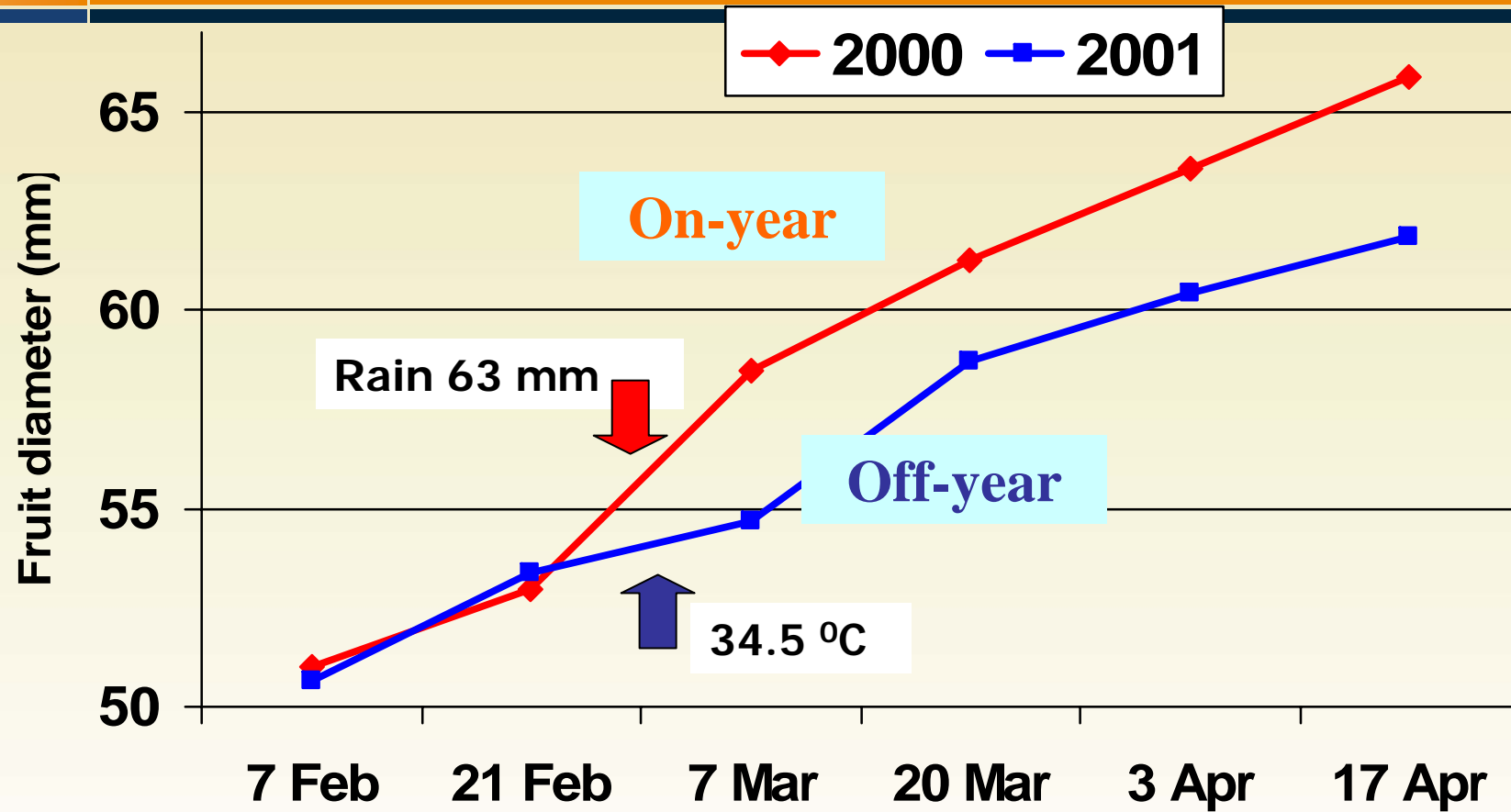
**Days > 40 °C**

High temp. → H<sub>2</sub>O stress → Stomatal closure → red. CO<sub>2</sub> assim.

Negative Carbon balance: Fruit drop increase



# Influence of climate on orange fruit growth



## Sun burnt fruit at ARAC, Dareton

Navel orange

Satsuma mandarin

Sunburn due to  
>40 °C recorded (2-5 Feb)



# Colour development

- Rind Colour development - onset of cooler weather
- Decrease in Chlorophyll and increase in carotenoid biosynthesis
- Cool days/cold nights/cold soils Temp.

25/5 °C for 2 months



# Red blood oranges grown at Dareton

Ruby Blood

Sanguine

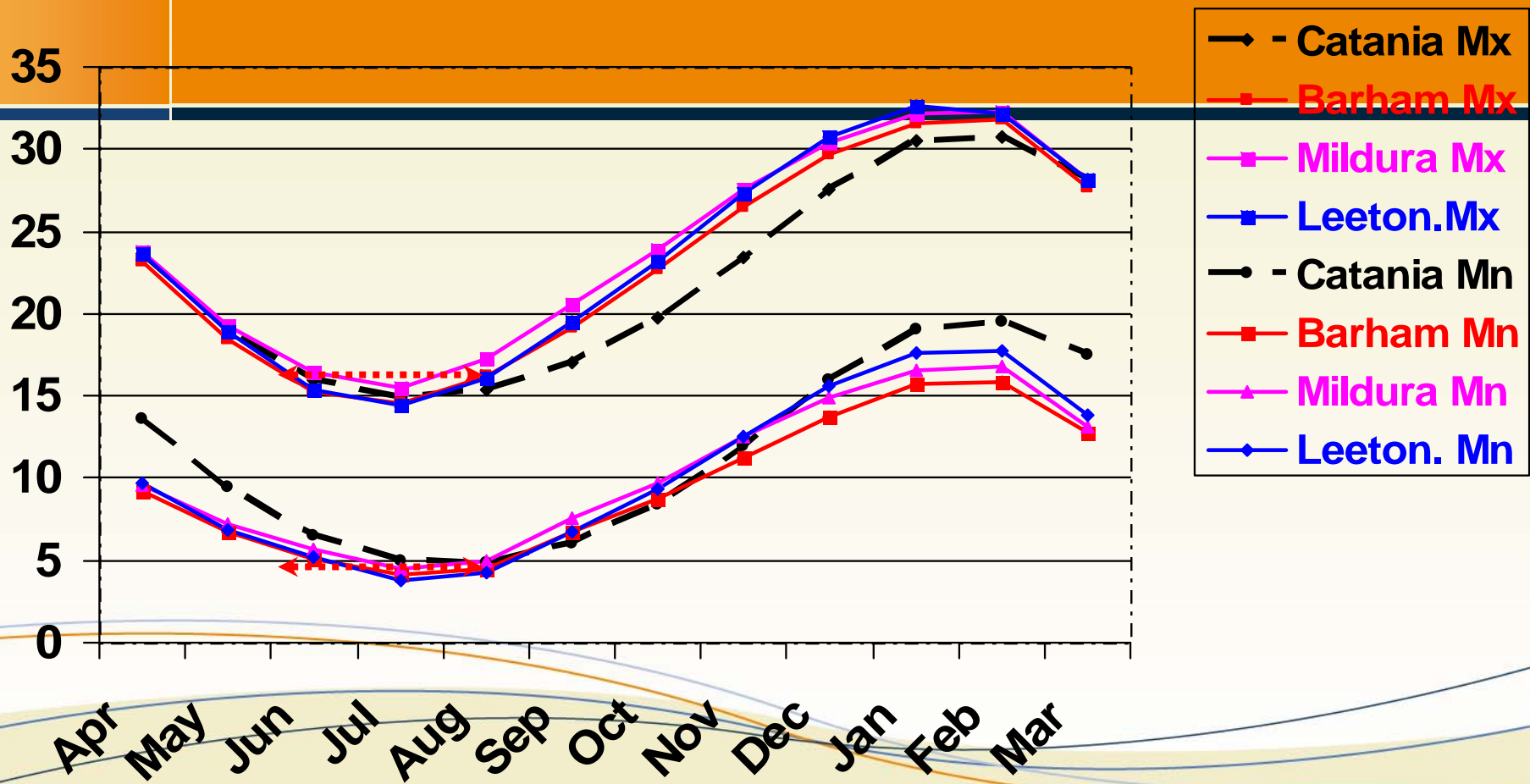
Harvard Blood

Maltese Blood

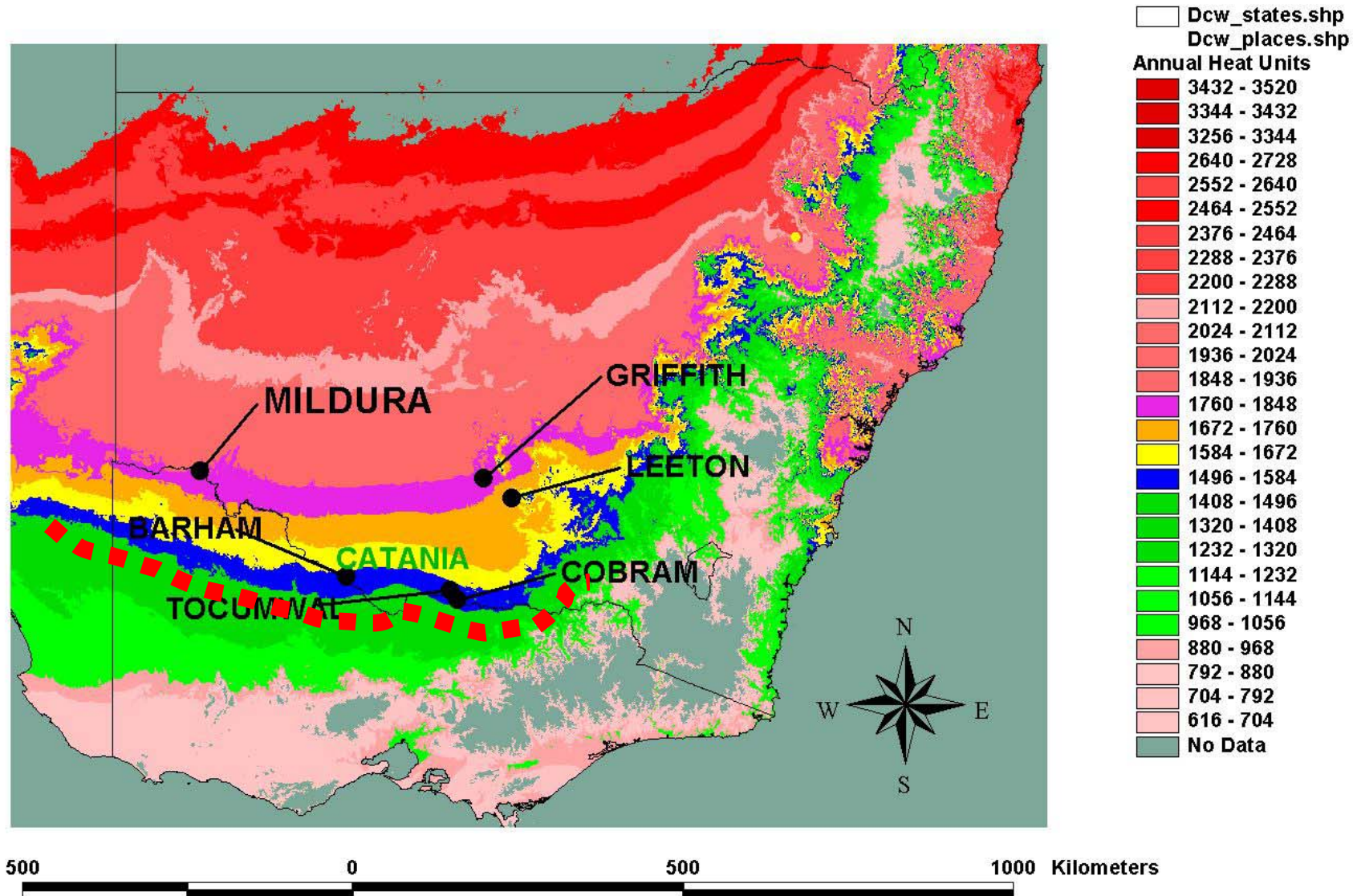


Arnold Blood

## Comparison of Max. and Min. Temperatures



# Predicted areas for blood oranges?



## Possibilities

- Area of production
  - Variety shift
  - Maturity/quality
  - Disease/pests/weeds
  - Irrigation management (drip)
- 