

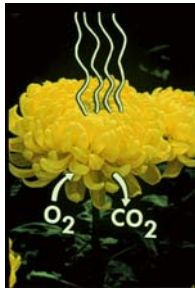
The Importance of Temperature

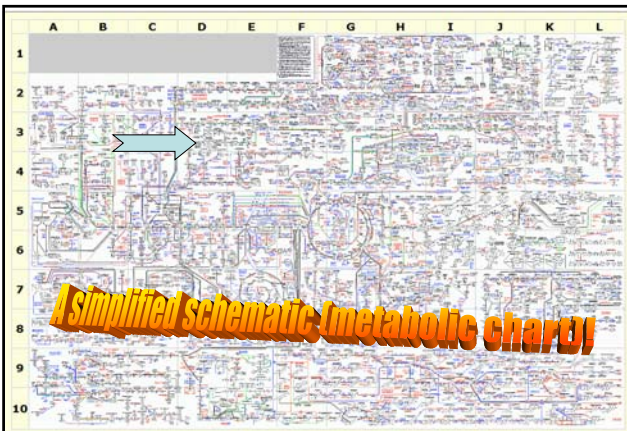
31st Postharvest Short Course, June 2009

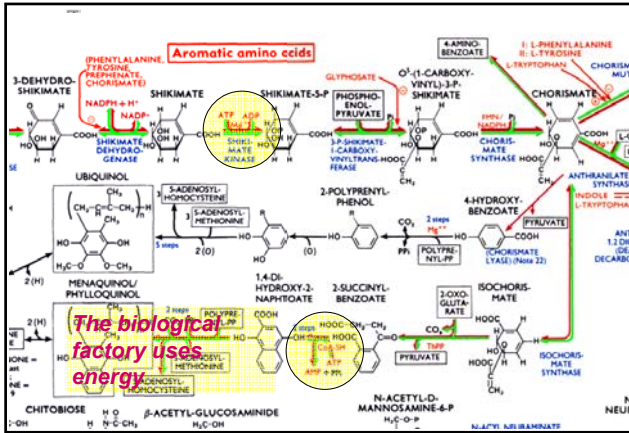


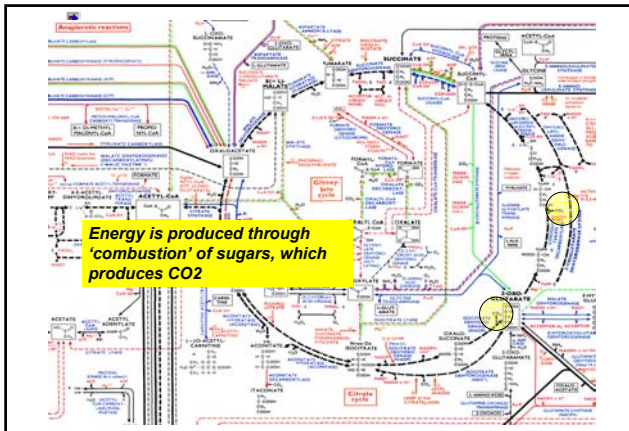
Respiration

- Perishable products are alive
- Life is a complex biochemical process
- Each cell is a minute factory carrying thousands of tasks simultaneously










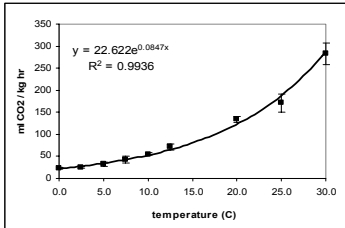
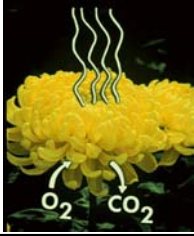
RESPIRATION

- The combustion of sugars is called respiration
- The process uses oxygen and produces CO₂ and energy
 - $C_6H_{12}O_6 + 6O_2 = 6CO_2 + 6H_2O$
- We can determine the rate of development and aging by measuring the rate of CO₂ production
- Like determining activity in a factory by watching the smoke-stacks



Temperature - why is it important?

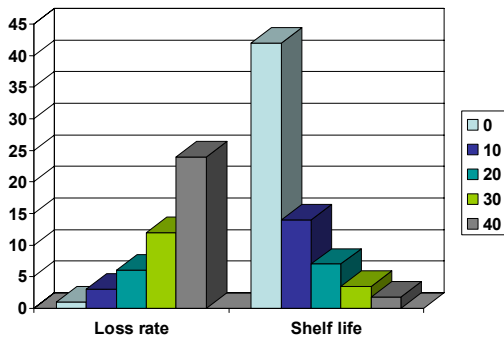
- Rate of deterioration \propto rate of respiration
- Faster respiration, shorter life
- Respiration increases exponentially with T



Temperature effects on product life

- As temperature increases, the rate of deterioration increases *exponentially*
- For every 10 C increase in temperature, the rate of deterioration increases 2-3 fold
- This increase is described by the Q₁₀ - the ratio of respiration at temperature T + 10 to that at temperature T
- High temperatures also accelerate water loss, disease growth, appearance of disorders, and unwanted growth of plant parts

The Effects of Q10



Example Strawberries

- How long do they last at room temperature?
- $Q_{10} = 2$
- Life at 10 C?
- Life at 0 C?
- We can store strawberries for two weeks at 0 C (if we control *Botrytis*)



Temperature also affects other factors that affect product life

- Ethylene
- Water loss
- Damage
- Disease
- Food supply
- Growth



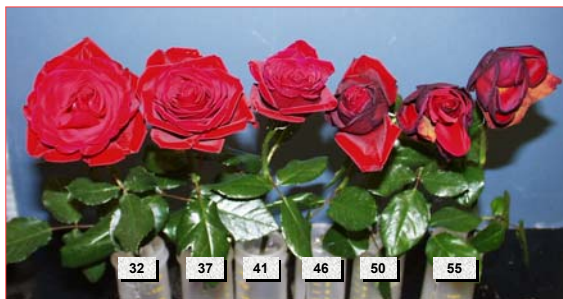
The 'real' world



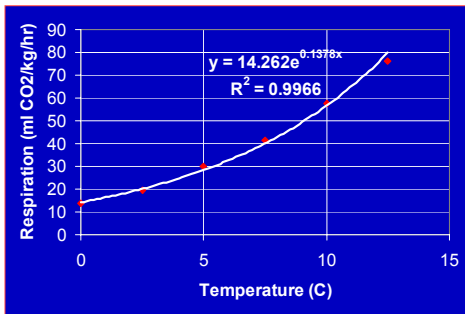
Storage experiments



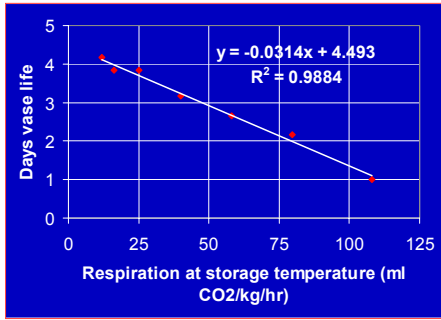
First Red Roses



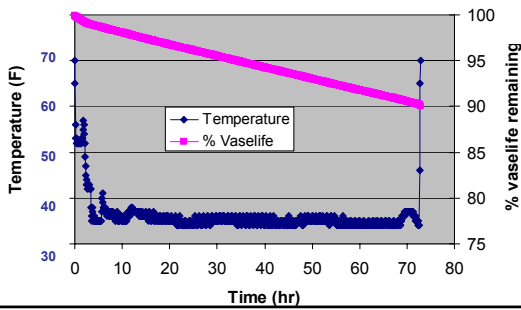
Narcissus Temperature & respiration



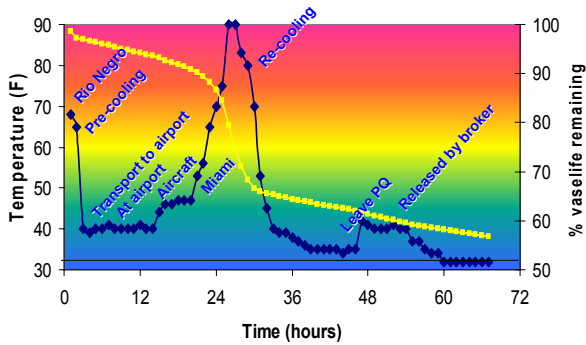
Narcissus Respiration & Vase life

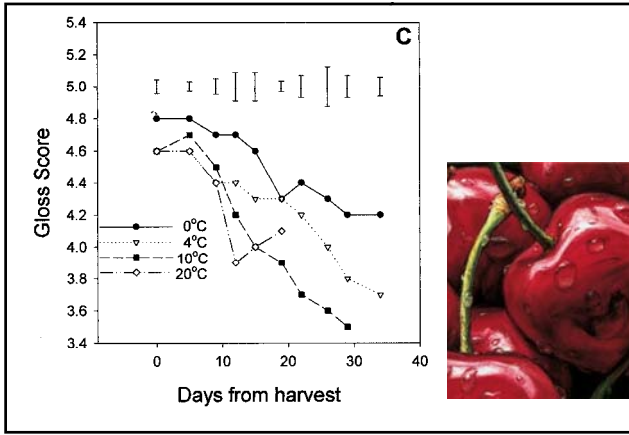


Flowers lose vaselife even under good temperature management



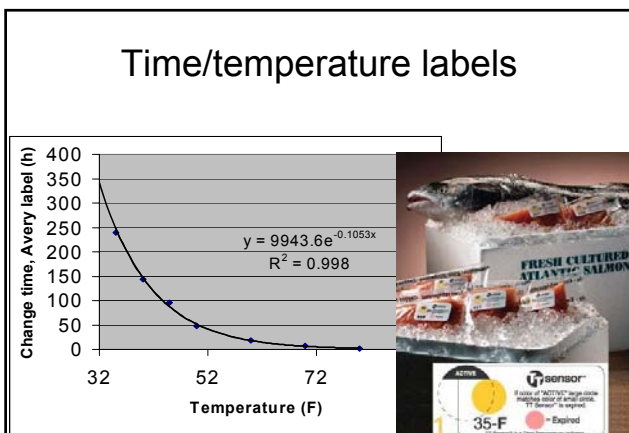
The Miami Problem





Monitoring tools

- Dataloggers
- Time/temperature labels
- Active RFID



A new tool - active RFID tags



- Radio Frequency Identification Chip
- Antenna receives and transmits information in RF signals
- Passive chips already in widespread use (Walmart)
- Active tags include battery
 - Environmental sensors

Battery Assisted RFID Tag

- Long range identification
- Data tracking
- Time/temperature monitoring
- Sensor monitoring



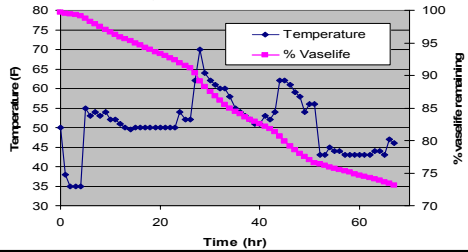
Time/temperature tags

- Programmable
- Target cost – 35 cents
- 5-year battery
- Re-usable



Shelf-life model

- Based on respiration regressions
 - By species or cultivar
- Predicts remaining 'vase life'
- In pilot testing with active RFID



Pilot Study

- 11 wholesalers sent tags to 48 domestic and offshore growers
- At the time of packing, the tags were placed into the flower boxes, which were shipped to the wholesalers
- The tags provided transit time and temperature data
- Our respiration/temperature model was used to calculate remaining vase life



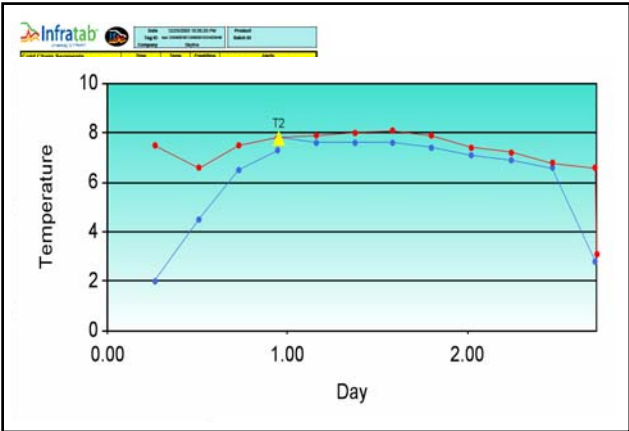
Results

- Average transit time – 5 days
 - Minimum 1 day (air from CA)
 - Maximum 11 days (sea from Colombia)
- Average temperature – 54°F
 - Highest – 63°F
 - Lowest – 41°F
- Average vase life loss – 14%
 - Maximum 41%
 - Minimum 3%

There will be no secrets!







Questions?

