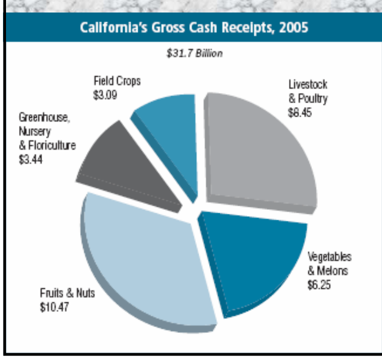
Postharvest Biology Overview

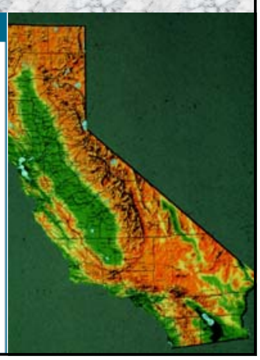
31st Short Course

Postharvest Technology of Horticultural Crops

June, 2009

Agriculture in California





Agriculture depends on postharvest technology

- Improved quality
  - Taste
  - Nutritional
- New products
- Niche markets
- Lightly processed
- Food safety
- Reduced losses!

Example - India

- India needs better postharvest!
- India is the world's 3rd largest producer of fruits & vegetables, yet consumption and exports are very small
- Losses (in value) average 50% during marketing
- Value equal to the Indian automobile industry!
- High losses mean small margins, yet high prices
- High prices lead to low consumption

Volumes & prices of cauliflower in New Delhi

Governing Coalition P

By Celia W. Dugger
New York Times Service

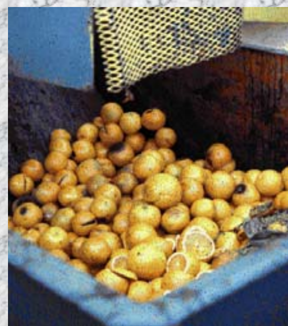
NEW DELHI — As vote tallies piled up here, the humiliating defeat of the Hindu nationalists and the stunning resurrection of India's once-dominant political force, the Congress (I) Party, became ever more stark Sunday.

Voters outraged by the spiraling prices of onions, tomatoes and potatoes swept the Hindu nationalist Bharatiya Janata Party from office by landslide margins where it had been deeply entrenched: in the northern region of Delhi, where the capital is located, and in the Hindi ... of Rajasthan.

said it w blamed th the Hin creases. Whi leader the go grou that cos

Losses include:

- Total loss
- Loss of quality
- Water loss
- Rots
- Damage



Characteristics of horticultural crops

- Alive
- Respiring
- High water content
- Diverse
  - genome,
  - tissue type,
  - physiological state

Factors contributing to postharvest losses

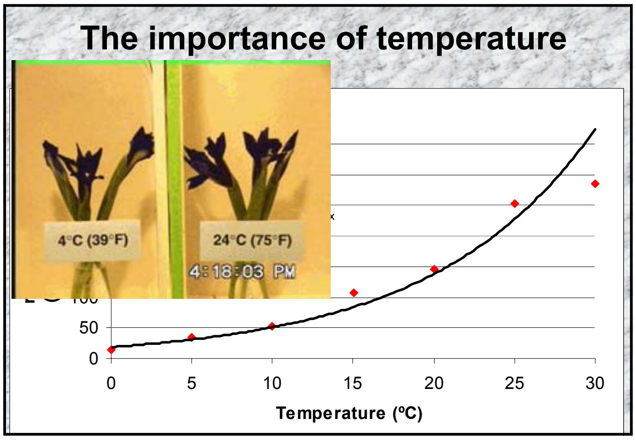
- Temperature
- Water relations
- Damage
- Diseases
- Ethylene
- Continued growth
- Nutrition

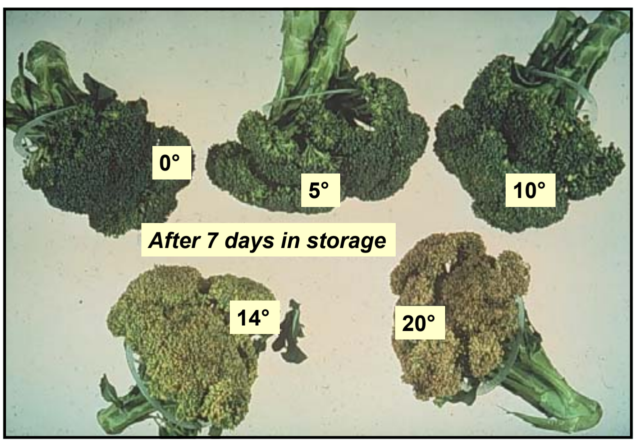
Diversity – plant parts

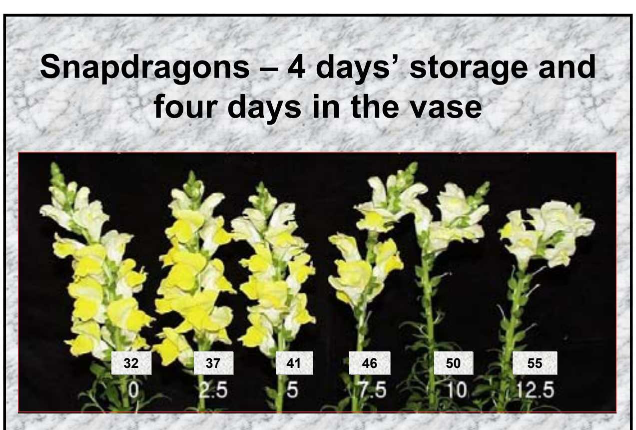
Diversity – physiology

Respiration

- Perishable products are alive, growing, and aging
- Growth and aging require energy
- Energy is produced by respiration
  - (oxidation of sugars, production of CO_2)
- A primary goal of postharvest technology is therefore to reduce respiration


The importance of temperature
4°C (39°F)
24°C (75°F)
4:18:03 PM
50
0
0
5
10
15
20
25
30
Temperature (ºC)


0°
5°
10°
After 7 days in storage
14°
20°

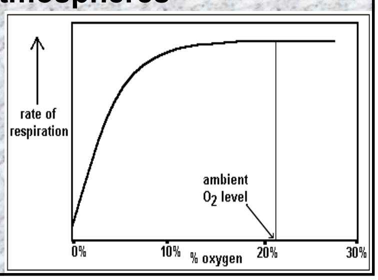

Snapdragons – 4 days' storage and four days in the vase
32
0
37
2.5
41
5
46
7.5
50
10
55
12.5

Cool storage is critical

- Best tool for maintaining product quality
  - Taste, texture
- Reduces water loss
- Reduces growth of postharvest diseases
- Reduces response to ethylene
- Required for effective use of other tools

Other tools for reducing respiration

- Controlled atmospheres
  - Low O_2
  - High CO_2



Stored for 14 days at 12.5 C (55 F)

Water

- Products are mostly water
- Water loss leads to loss of:
  - quality (appearance, texture)
  - weight (and possibly grade)
  - volume (transportation problems)

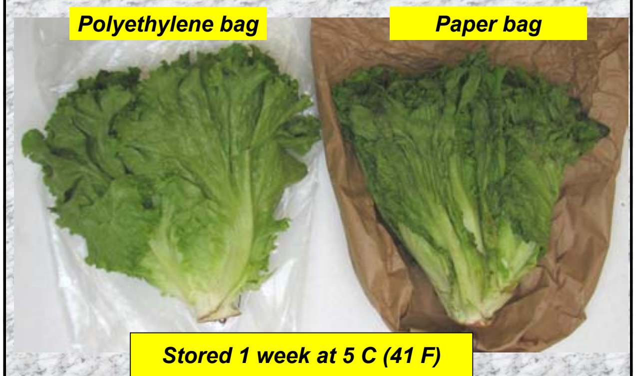
Water loss

- Products are covered with holes - needed to breathe
- Loss is a function of the vapor pressure gradient
- increases *exponentially* with rising temperature
- Increases linearly with lower humidity

Preventing water loss

Reduce Vapor Pressure Gradient

- Reduce temperature
- Increase external VP
  - polyethylene bags
  - increase humidity
- Beware of condensation
  - disease!



Damage

- Perishable products are delicate
  - Large mass (inertia)
  - Delicate skin
- Damage easily
- Damage causes
  - Quality loss
  - Water loss
  - Disease susceptibility

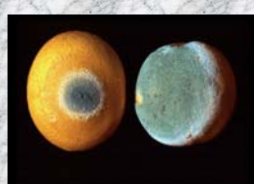
Preventing damage

- **CARE!**
  - Careful harvesting
  - Into lined bins or buckets
  - Don't throw, dump, or drop
  - Avoid rough surfaces
  - Pack gently but securely

What's wrong with this picture?

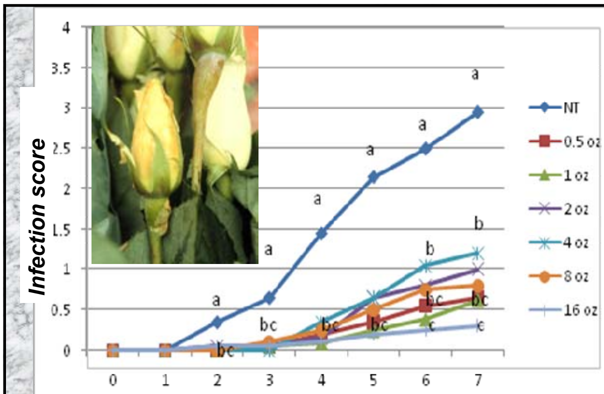
Diseases

- Major cause of loss
- Relatively few important fungal genera
  - *Grey mold, Blue Mold, Brown Rot, Black Rot, etc.*
- Many products are not infected



Controlling diseases

- Temperature
  - Low during storage
  - High for disinfestation
  - Steady to prevent condensation
- Sanitation
- Fungicides



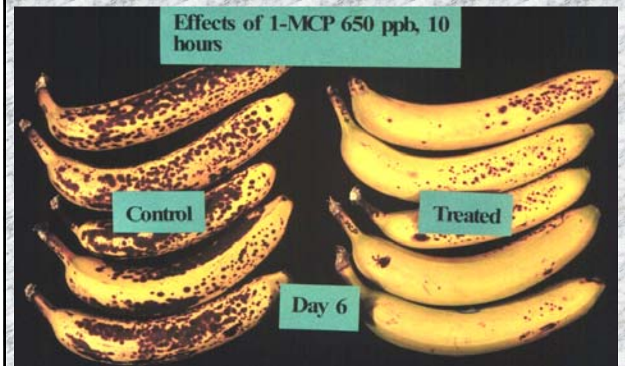
Effect of a fungicide dip on Botrytis development

Ethylene

- Simple and common hydrocarbon
  - Air pollutant, produced by ripening fruits
- Important tool in postharvest biology
- Temperature important in control
  - Useful in ripening fruits
  - Useful in harvesting
- Important source of losses
  - Premature ripening
  - Accelerated flower wilting
  - Loss of leaves and flowers

Controlling ethylene effects

- Temperature
  - Low temperatures prevent ethylene action, reduce ethylene production
- Inhibitors
  - AVG, AOA reduce ethylene synthesis
  - STS, 1-MCP inhibit ethylene action
  - 1-MCP
    - EthylBloc for flowers
    - SmartFresh for fruits and vegetables



Continued growth

- Sprouting
- Growth away from gravity
- Growth towards light
- Can cause quality loss
  - asparagus, snapdragons
- Control
  - temperature
  - orientation
  - chemicals

Physiological disorders

- Disorders resulting from abnormal conditions during production and marketing
- Abnormal temperatures
- Extended storage
- Abnormal gases
- Nutritional imbalance

Physiological disorders -

Abnormal temperatures

- The temperature window
  - temperate fruits and cool-season vegetables

Physiological disorders -

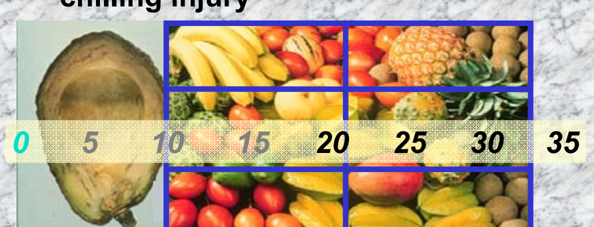
Low temperatures

- Below the temperature window
  - freezing injury

Physiological disorders -

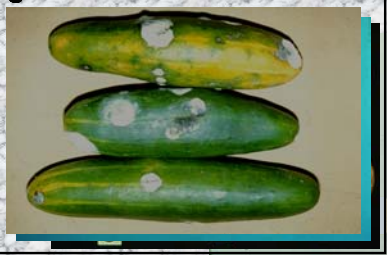
Low temperatures

- Below the temperature window
  - chilling injury



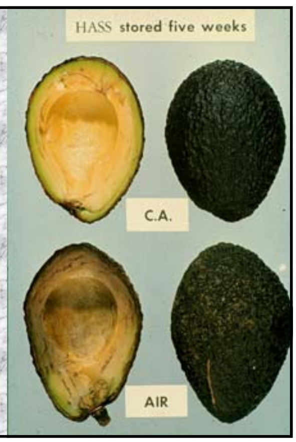
Chilling injury symptoms

- Surface pitting
- Water soaking
- Browning
- Necrosis
- Rots



Preventing Chilling Injury

- Temperature control
- Atmosphere control
- Conditioning
  - High temperatures
  - Low non-chilling temperatures



Physiological disorders -

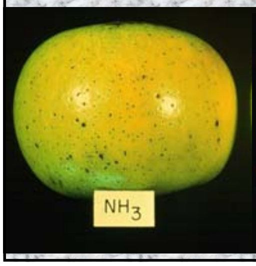
High temperatures

- Sunburn in persimmons, peppers
- Pit-burn in apricots


-5 0 5 10 15 20 25 35

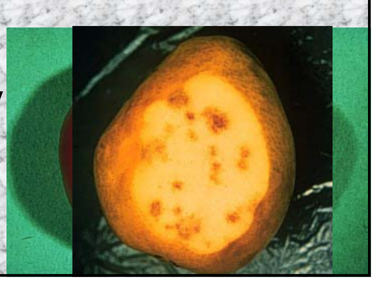
Postharvest gases

- NH_3, SO_2
- Excessive CO_2, low O_2



Improper nutrition

- Calcium deficiency
  - bitter pit
  - water core
  - blossom end rot
- Boron deficiency
  - cork spot



Questions?