

Maintain the Cold Chain



Harvest

- Harvest when product cool
- Protect the product from the sun

Cooling

- Reduce delays before cooling
- Cool product thoroughly ASAP

**Temporary
Storage**

- Keep product at optimum temperature
- Transport to market ASAP



Harvest

Cooling

Storage

Transport
to Market

Maintain the Cold Chain

- Use refrigerated loading area
- Cool truck before loading
- Load pallets towards center of truck
- Avoid delays during transport
- Monitor product temperature

**50-75% of storage life is
spent in a transport vehicle**



Harvest

Cooling

Storage

Transport

Handling
at destination

Handling at home
or Foodservice outlet

Maintain the Cold Chain

- Use refrigerated unloading area
- Measure product temperature
- Move product quickly to storage area
- Transport locally in refrigerated truck
- Display/store at proper temp. range

- Is problematic!!

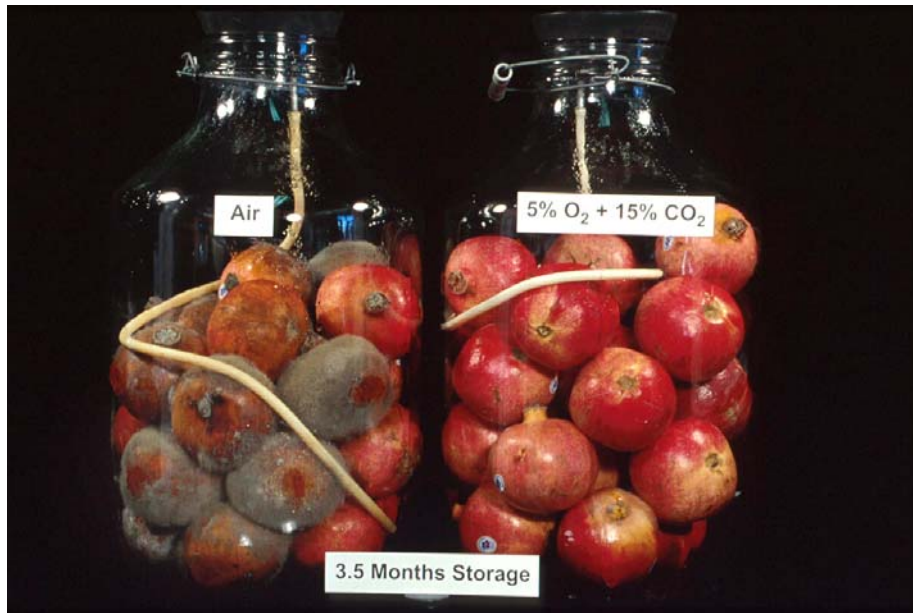
Postharvest Handling Challenges for Specialty Crops

3. Increased use of controlled and modified atmospheres

O₂, CO₂, C₂H₂ removal, N₂, other gases

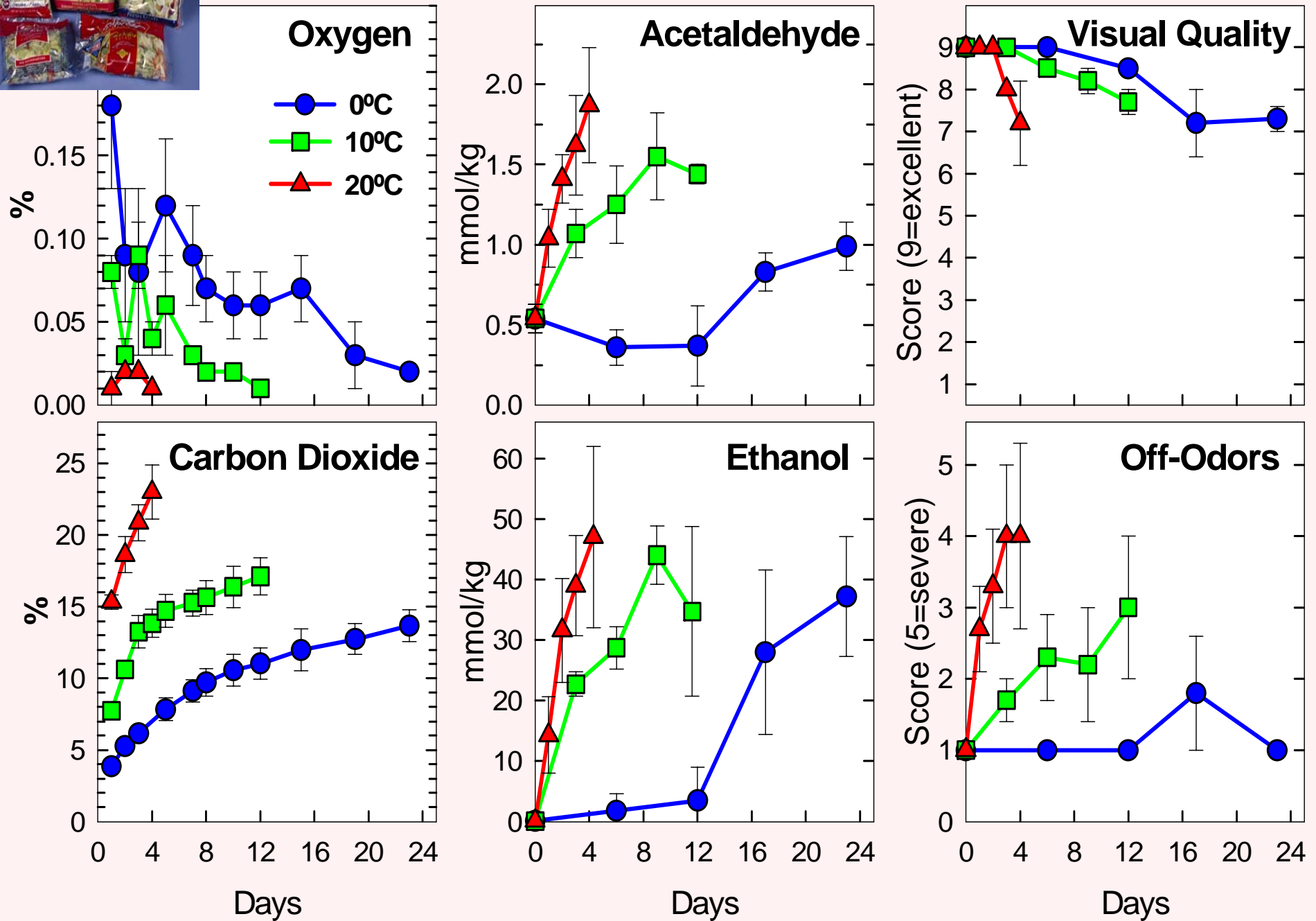
- **Traditional Use of CA/MA**
 - Long term storage of fruits and vegetables
- **Recent Uses of CA/MA**
 - Minimally processed products
 - Short-term mixed storage/transport
 - Pest and disease control

For Different Products, Different Atmospheres are Beneficial





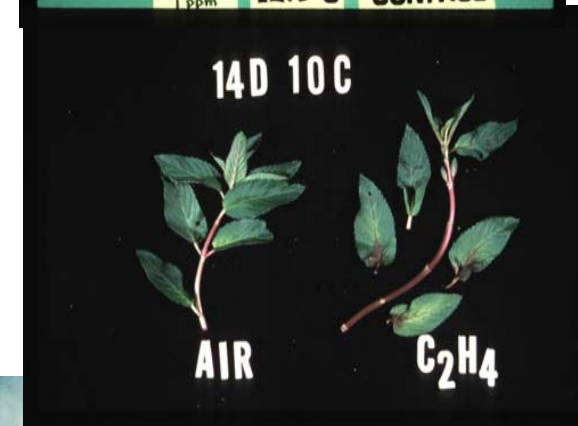
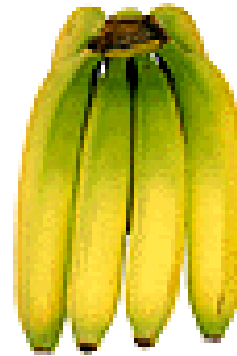
Temperature Effects on Salad Products



Postharvest Handling Challenges for Specialty Crops

4. Control detrimental ethylene effects

- **Useful:**
 - Part of normal fruit ripening
 - Accelerates ripening
 - Causes abscission
- **Problematic:**
 - Accelerates ripening
 - Accelerates senescence
 - Causes abscission
 - Bitterness in carrots



Compatibility Issues

- **Temperature**
- **Relative Humidity**
- **Ethylene**
- **Odor**



Transportation



Distribution warehouses



Retail & FS outlets

Overcoming ethylene effects

- 1. Avoid (Don't mix products; electric forklifts)**
- 2. Remove (ventilate, oxidize, absorb)**
- 3. Inhibit production (temperature, MA, AVG, molecular engineering)**
- 4. Inhibit action (temperature, MA, 1-MCP, molecular engineering)**
- 5. Germplasm selection, creation**

Postharvest Handling Challenges for Specialty Crops

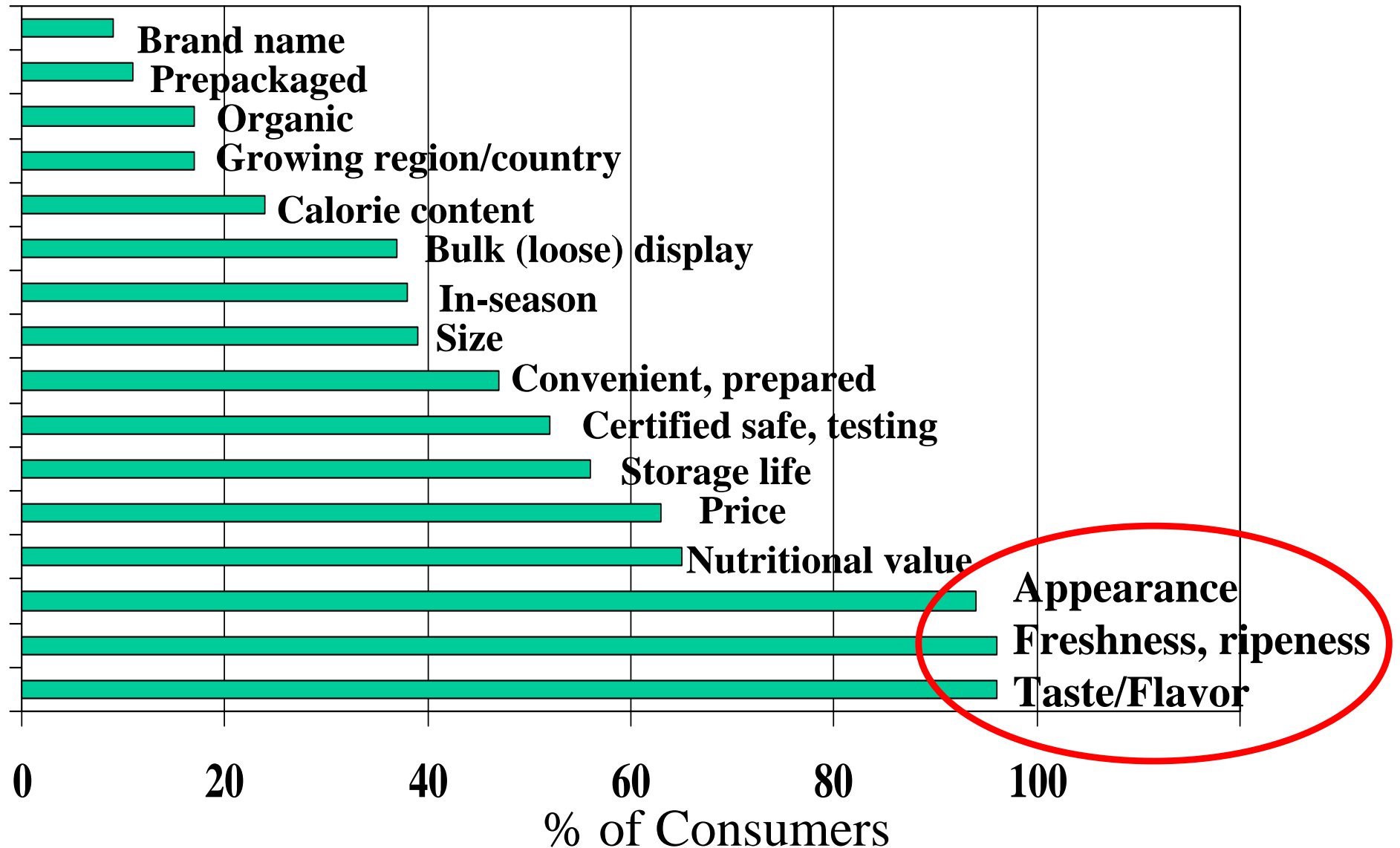
5. Improved sensory & nutritional quality

Sugars, acids,
Aroma volatiles
Amino acids, etc.

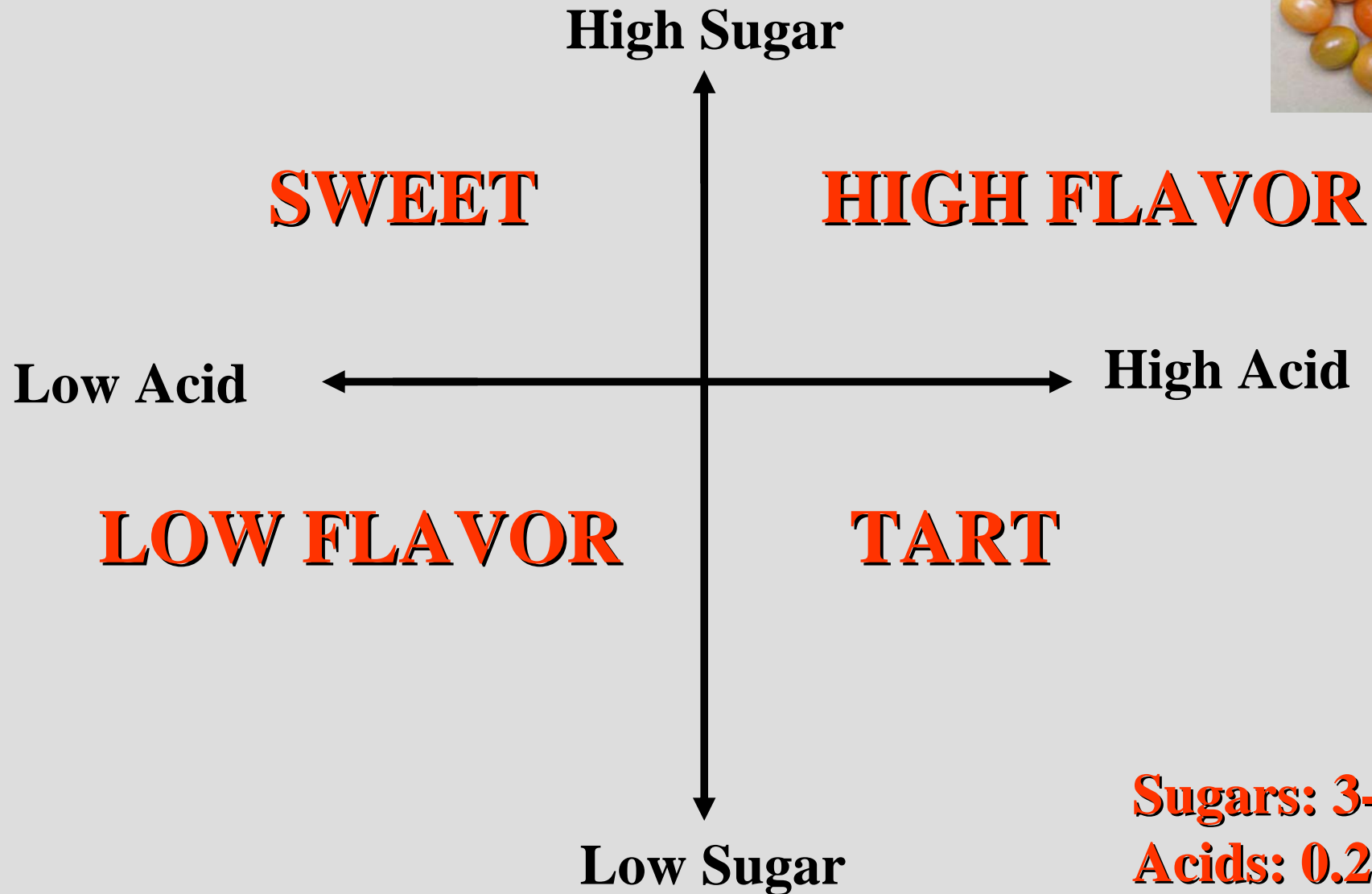
Antioxidants, pigments,
Phenolics, glucosinolates,
etc.

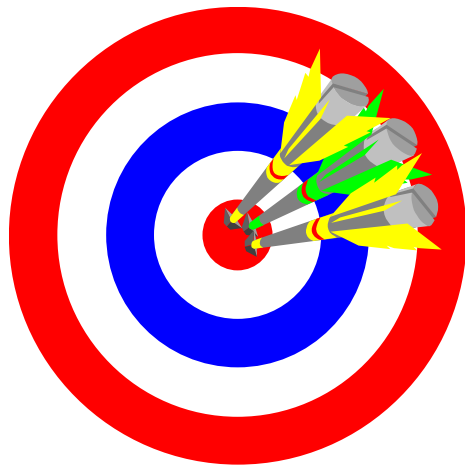
- Cultivar and variety selection, creation
- Stage of maturity at harvest critical
- Appropriate postharvest handling conditions
- Marketing period short rather than long

Factors that influence U.S. Consumers' Produce Purchases



Tomato Composition & Flavor





**Focus More on
Maintaining Quality
Than Extending Shelf-life**

Postharvest Handling Challenges for Specialty Crops

6. Increased product diversity

At retail: 140 products 1979
325 products 1999