

# Immature Fruit Vegetables

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Postharvest Technology Short Course

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## Immature Fruit Vegetables

### Causes of Quality Loss



- Beans
- Summer squash
- Okra
- Cucumber, chayote, other cucurbits
- Eggplant
- Tomatillo
- Sweet corn
- Peas



- Maturity
- Water loss
- Physical damage
- Chilling injury (most)
- Decay
- Internal seed development

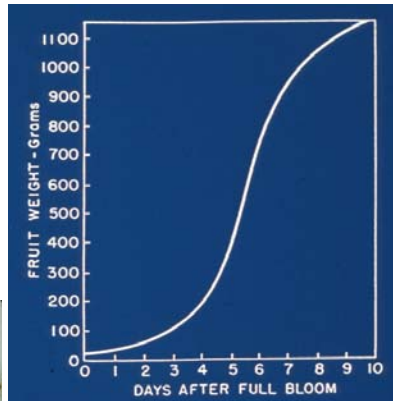
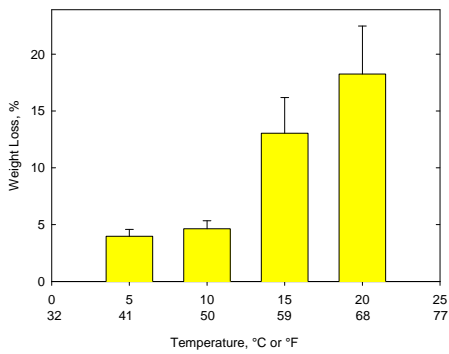


FIG. 23.4. Growth of zucchini summer squash. Max. temp. = 90°F, min. temp. = 60°F. Redrawn from Lorenz (1949).



Average weight loss of summer squash stored at 4 temperatures for 10 days.



Waxed carton, water absorbent pad,  
forced air cooled



Bulk pack in carton box,  
Forced air cooled  
Squash are showing initial  
symptoms of chilling injury.

SEVERE Chilling injury Symptoms  
Squash  
Water loss from the water soaked areas leads to sunken areas



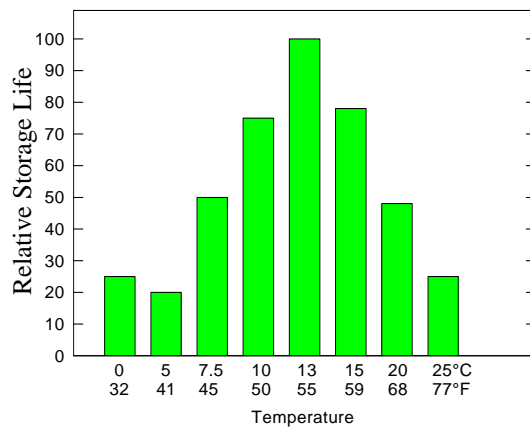


**Table 1.** The visual quality of summer squash varieties stored at 5°C (10°F) for 10 days. Jimenez variety trial, 1997.

Field #	Variety	Company	Visual Quality 10 days at 5°C (41°F)	Relative Chilling Susceptibility
18	Meigs (VGT996)	Asgrow	3.65	High
19	Senator (VGE485)	Asgrow	3.55	High
20	111F-1 (48-048-1015)	CA Valley	3.07	High
21	114F-1 (48-290-1005)	CA Valley	3.20	High
22	144F-1 (48-289-2005)	CA Valley	3.65	High
23	<b>HMX 7710</b>	<b>Harris Moran</b>	<b>6.15</b>	<b>Intermediate</b>
24	HMX 6704	Harris Moran	3.65	High
25	Golden Rod	Harris Moran	4.57	High
26	<b>Multipik</b>	<b>Harris Moran</b>	<b>6.00</b>	<b>Intermediate</b>
27	Superpik	Harris Moran	4.46	High
28	<b>Supersett</b>	<b>Harris Moran</b>	<b>6.96</b>	<b>Low</b>
30	Elite	Harris Moran	3.34	High
31	Puma	Harris Moran	6.60	Low
32	<b>Tigress</b>	<b>Harris Moran</b>	<b>6.43</b>	<b>Low</b>
34	Butter Scallop (TV-6402)	Rogers	5.82	Intermediate
35	<b>Starship (HV 6156)</b>	<b>Rogers</b>	<b>7.18</b>	<b>Low</b>

## Shelf-life of cucumbers in relation to temperature

**Chilling Sensitivity**  
**Exposure Time**  
**Temperature**



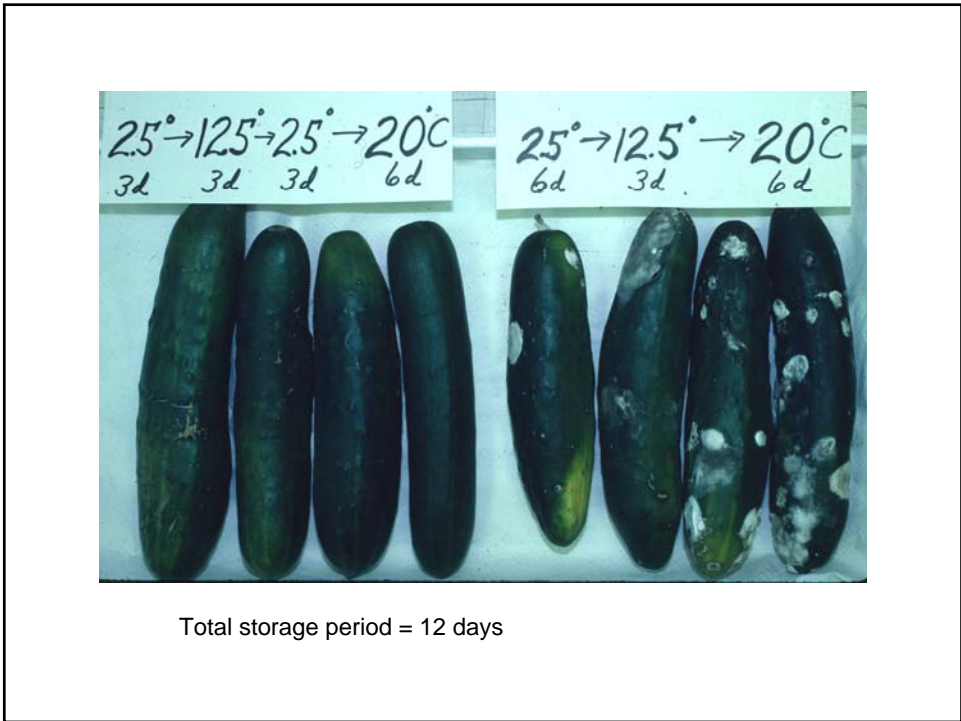
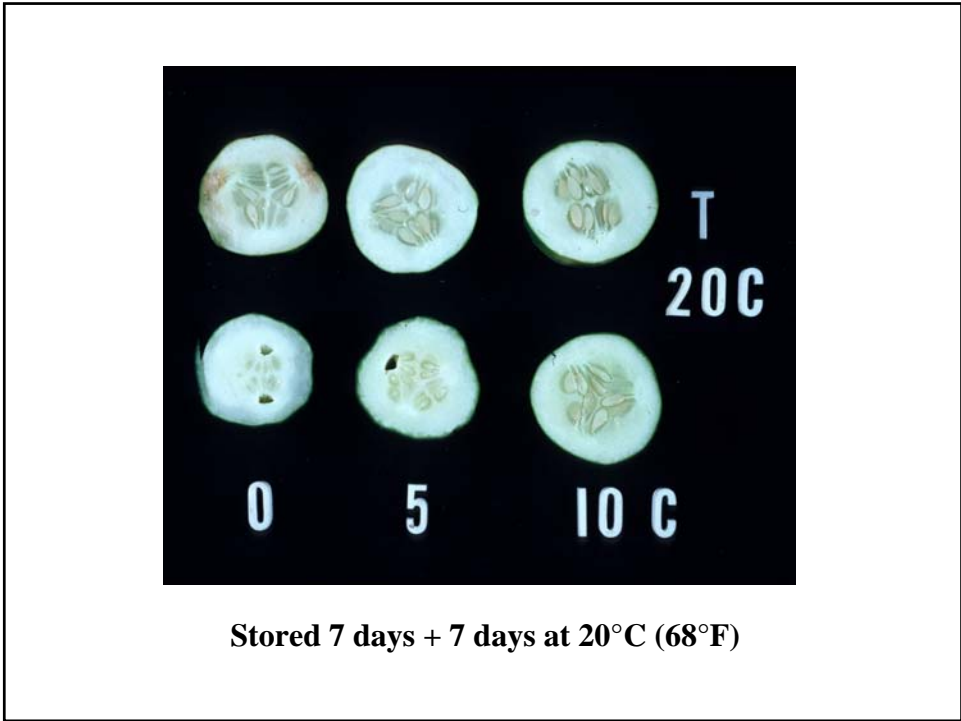
**Symptoms:**  
**poor ripening**  
**discoloration**  
**pits and sunken areas**  
**increased weight loss**  
**increased decay**



**Stored 7 days**

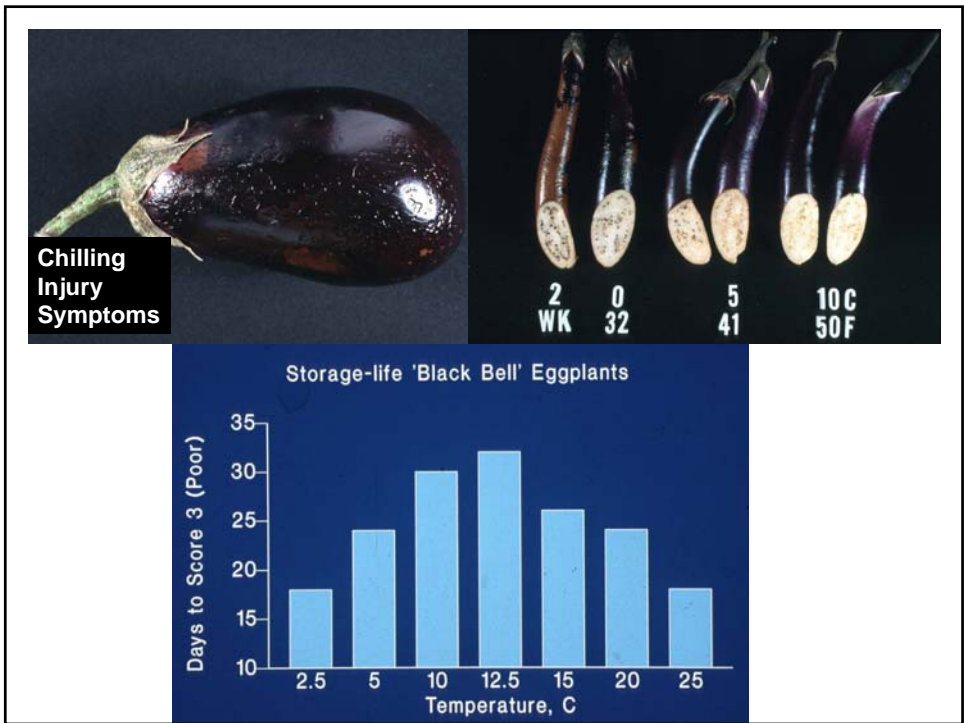


**Stored 7 days + 7 days at 20°C (68°F)**



Bittermelon  
and other  
Asian cucurbits





**Table 1.** Days to visual chilling symptoms. Chilling symptoms included fruit pitting, discoloration of the fruit and calyx, and internal discoloration. Symptoms were considered to reduce marketability when scores exceeded 2.0 (slight) on a 5 point scale.

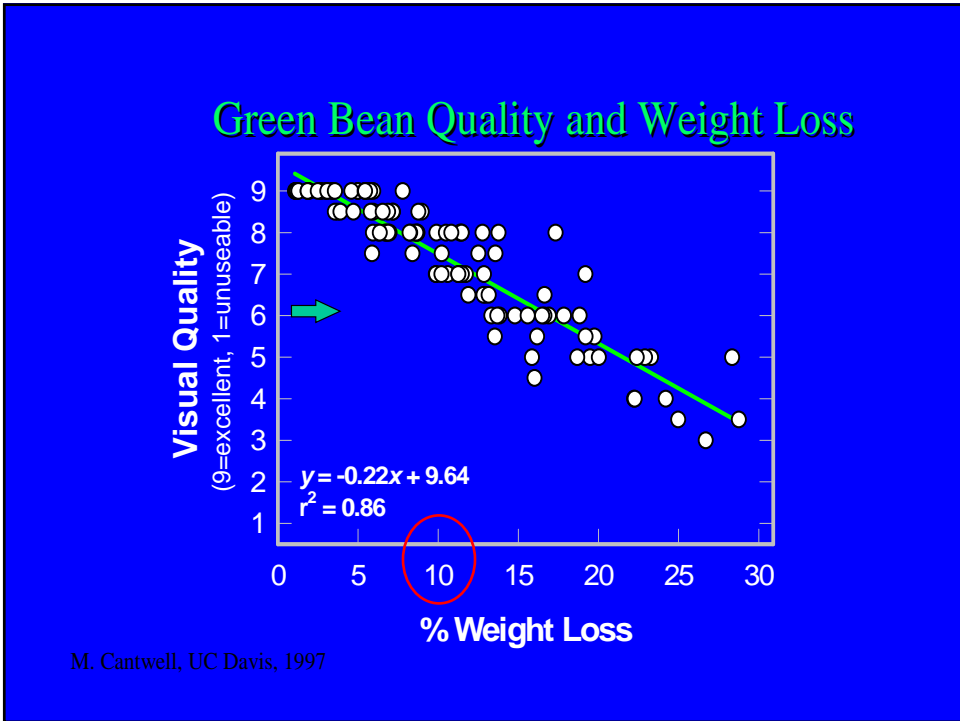
		Days to Visible Chilling Symptoms		
Temperature		Black Bell	Japanese	Chinese
0°C	32°F	1-2	--	2-3
2.5°C	36°F	4-5	5-6	5-6
5°C	41°F	6-7	8-9	10-12
7.5°C	45°F	12	12-14	15-16
10°C	50°F	no chilling	no chilling	no chilling

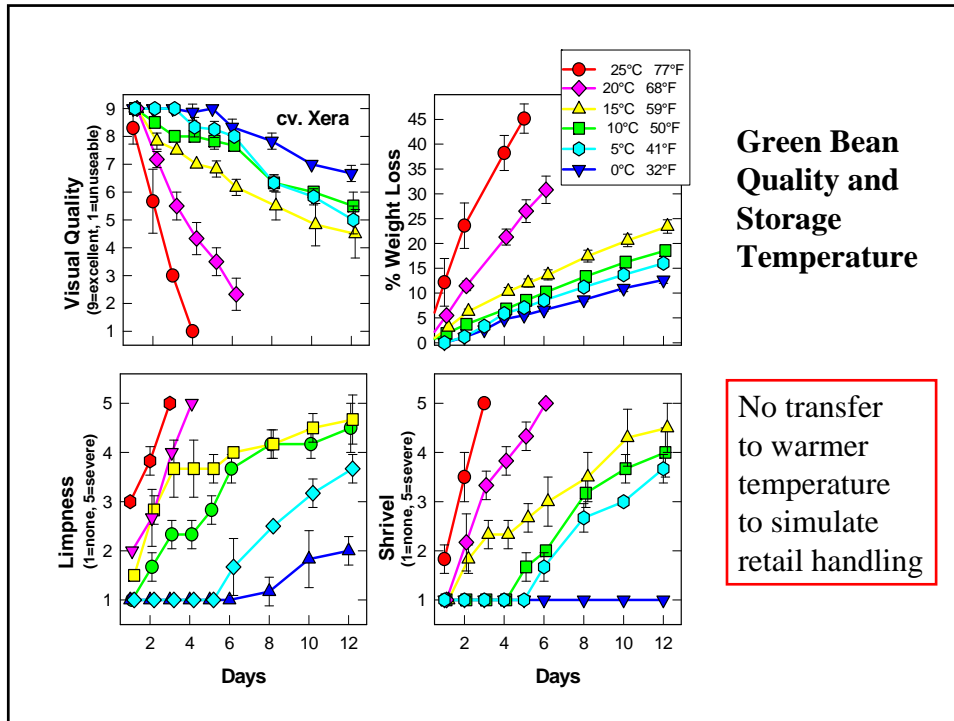


Tomatillo postharvest  
Problems

Maturity  
Husk and decay







## Symptoms of chilling injury

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

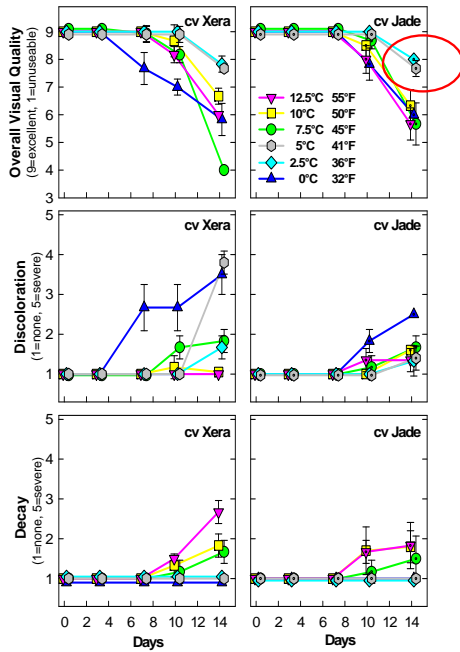
Green Beans: Chilling symptoms are different at different temperatures  
 Stored 7-10 days



**0°C  
32°F**



**5°C  
41°F**



**Beans evaluated  
 after transfer  
 to 15°C (59°F)  
 for 12 hours**

## VISUAL SYMPTOMS OF CHILLING INJURY ON SELECTED FRUIT VEGETABLES

Vegetable	Symptoms
Beans	Surface pitting, diagonal brown streaks, dullness of normal surface color, discoloration of seeds, increased susceptibility to decay
Cucumbers	Shallow surface pits of various sizes, water-soaked spots, and increased decay
Eggplant	Pitting: brown surface areas that become sunken with time; calyx discoloration, and flesh browning
Peppers, bell and chili	Numerous minute to fairly large, shallow, roundish surface depressions (sheet pitting), seed browning, and calyx discoloration
Okra	Discoloration, water-soaked areas, pitting, and increased calyx discoloration
Squash, summer	Surface pitting and rapid decay



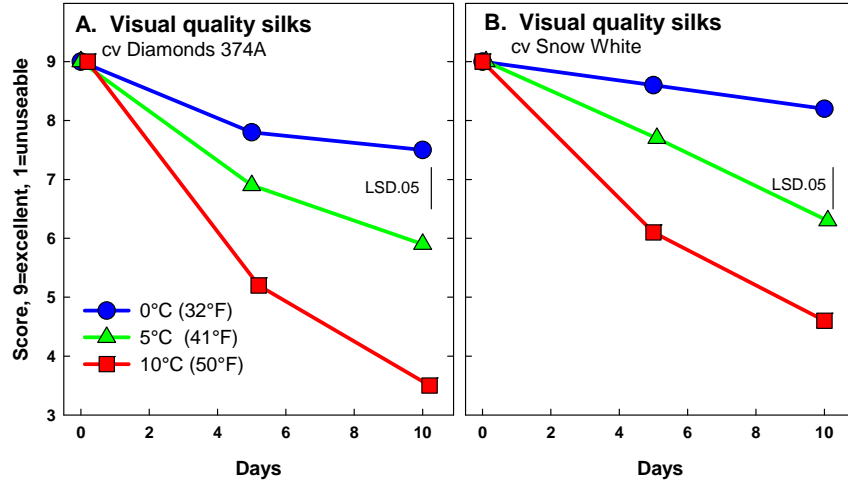
### Sweet corn quality

Fresh green husks  
 No decay on silks  
 Tender kernels  
 Typical flavor-sweet, not starchy





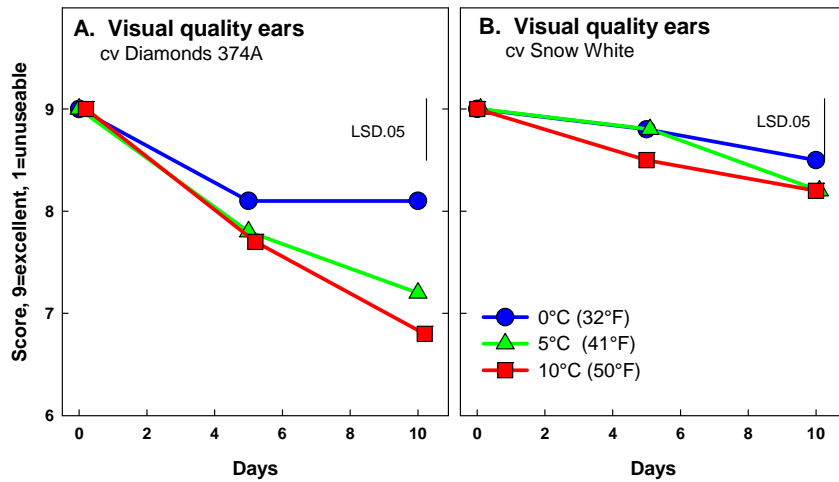
## Temperature and Visual Quality Silks



Cantwell, 2003

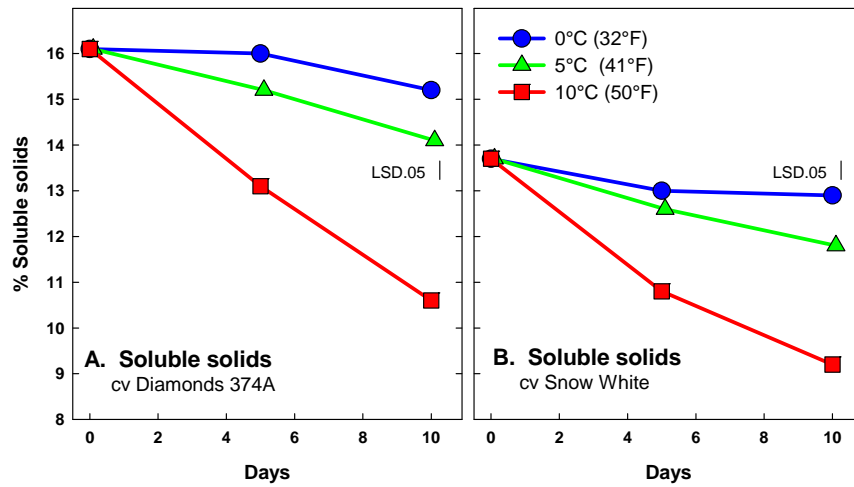


## Temperature and Visual Quality Husked Ears



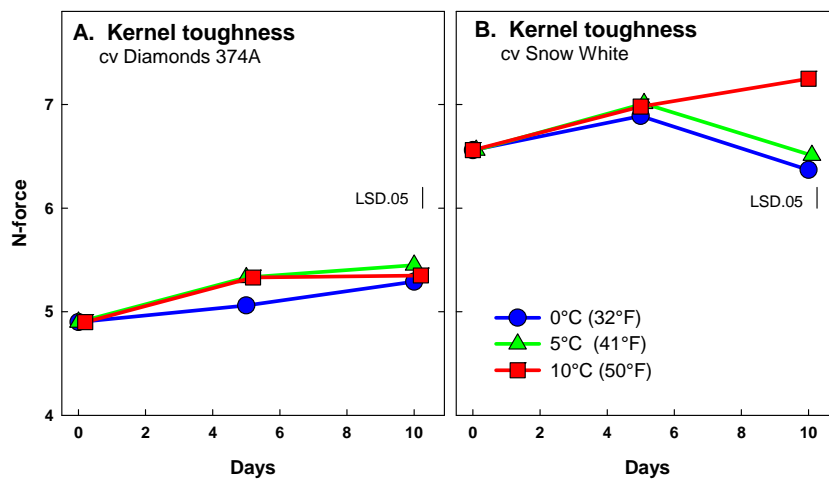
Cantwell, 2003

## Temperature and Loss of Soluble Solids



Cantwell, 2003

## Temperature and Kernel Toughness



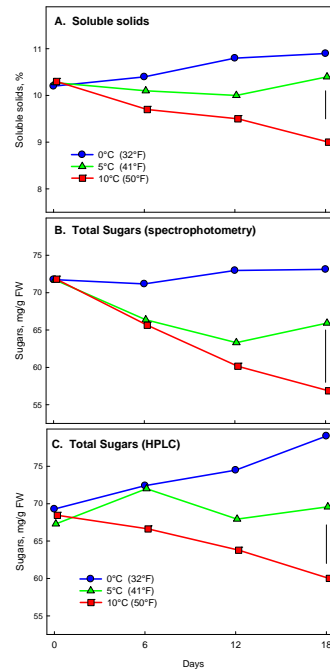
Cantwell, 2003

Appearance of sugar snap peas stored at 0, 5 or 10°C (32, 41 or 50°F) for 18 days.



Temperature impacts flavor (sweetness) More than visual appearance in sugar Snap peas. However, best quality and Longest shelf-life achieved at 0°C (32°F).

Cantwell and Paulenas, 2008



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