

Cucumbers

Revised 2018

Thermal Properties

	English	Metric
Moisture, %	95.23	--
Protein, %	0.65	--
Fat, %	0.11	--
Carbohydrate, %	3.63	--
Fiber, %	0.50	--
Ash, %	0.38	--
Specific Heat Above Freezing	0.98 Btu/lb*°F	4.09 kJ/(kg*K)
Specific Heat Below Freezing	0.41 Btu/lb*°F	1.71 kJ/(kg*K)
Latent Heat of Fusion	138 Btu/lb	321 kJ/kg

Storage Conditions

	Fresh	Brine Stock	Pasteurized
Temperature	50 to 55°F (10 to 13°C)	65 to 40°F (18° to 4.4°C)	40°F (4.4°C)
Relative Humidity or Packaging	95%	Barrels or Vats	Hermetically Sealed Containers
Storage Period	10 to 14 days	4 to 12 months	12 months
Highest Freezing Point	31.1°F (-0.5°C)		

Cucumbers are immature fruit that are harvested within a narrow size range that occurs while the fruit are rapidly enlarging. This makes cucumbers extremely perishable, and rapid cooling after harvest is critical for successful storage. Forced-air cooling is the most common method used to cool cucumbers. They may also be hydrocooled in shower-type systems using about 41 to 50°F (5 to 10°C) water. It is recommended that potable water chlorinated at 50 ppm and adjusted to pH 7 be used in order to avoid transfer of decay and pathogenic organisms to the products during hydrocooling.

Cucumbers are chilling sensitive. Cultivars differ, but generally they are subject to chilling injury (CI) if held longer than about 2 to 5 days at temperatures below 50°F (10°C). At these temperatures they eventually show water-soaked patches, pitting, shriveling, and tissue collapse. Extensive decay develops on chilled cucumbers when they are removed from low-temperature storage. The susceptibility of cucumbers to chilling injury does not preclude their exposure to temperatures below 50°F (10°C) for short intervals, as long as they are utilized immediately after removal from cold storage. Chilling

symptoms develop rapidly only at higher temperatures after low temperature storage. Thus, 2 days at 32°F (0°C) or 4 days at 40°F (4.4°C) are harmless under these conditions.

At temperatures higher than recommended, cucumbers rapidly turn yellow and quality deteriorates. This color change is accelerated if the cucumbers are stored in the same room with apples, tomatoes, or other ethylene-producing crops for more than a few hours. Even 1 ppm ethylene may cause yellowing in 1 day. Yellowing can be retarded by holding cucumbers in a controlled atmosphere (CA) of about 3 to 5% oxygen, allowing storage for about 3 weeks. Cucumbers may also yellow rapidly if they have been harvested too mature.

Cucumbers are very susceptible to shriveling. The relative humidity (RH) should be kept at about 95%. In addition, fresh market cucumbers are usually waxed to minimize moisture loss and improve their appearance. Shrink-wrapping with polyethylene film can also prevent moisture loss and is a widespread practice for European-type greenhouse cucumbers. A higher temperature, 55°F (12.8°C), is recommended for these greenhouse cucumbers, allowing 1 to 2 weeks storage. Coatings and wraps that reduce shriveling also reduce development of CI symptoms (but not the injury).

Pickling cucumbers can be stored at 34 to 36°F (1.1 to 2.2°C) with 90 to 95% RH for 1 week if processed immediately on removal from storage. They will develop CI symptoms if not processed promptly. Pickling cucumbers should be hydrocooled after harvest, particularly if mechanically harvested during hot weather, as they respire faster and produce more ethylene than if hand harvested. In some cases, they are iced for transport before processing. Use only potable water for making package ice.

Diseases and Injuries

Bacterial Soft Rot	Water-soaked and pronounced softening of flesh, which is eventually liquefied by the pathogen. Usually has offensive odor. Control: Handle carefully to avoid mechanical injury and store promptly at 50°F (10°C).
Black Rot	Irregular, brownish, water-soaked spots of different sizes, later nearly black. Control: Cull out affected cucumbers before storage. Keep temperature between 50 and 55°F (10 and 12.8°C), but not lower.
Cottony Leak	Large greenish, water-soaked areas, later covered by white, cottony mold. No disagreeable odor, much leaking from decayed cucumbers. Worse following periods of hot, wet weather. Control: Cull out before storage. Cool rapidly and keep temperature between 50 and 55°F (10 and 12.8°C), but not lower.
Scab	Grayish sunken spots, quite shallow, later covered with dark olive-green fungus layer. Favored by cool, moist weather. Serious disease mainly on greenhouse cucumbers or those for pickling. Control: Field sanitization. Nothing that a warehouseman can do except refusal of storage unless diseased cucumbers are culled. Decay already started will develop in storage, but

	new lesions will not occur.
Chilling Injury	<p>Numerous sunken, slightly water-soaked areas, pitting of skin. Prolonged chilling causes increased decay. All symptoms develop more rapidly on removal from chilling temperatures.</p> <p>Control: Do not store at temperatures lower than 50°F (10°C) unless cucumbers will be used immediately afterwards and storage period will be less than 5 days.</p>

Brine Stock Pickles

Cucumber pickles may be packed from fresh cucumbers or from cucumbers fermented in a brine of salt. In either case, it is important to minimize growth of molds, which release enzymes that can soften salt stock over a wide range of brine-salt concentrations. This can be reduced by completely filling air-tight barrels, thereby preventing mold growth. Since barrels are subject to brine leakage, they should be examined at regular intervals to ensure absence of air space and maintenance of appropriate brine concentration. Firmness and skin toughness of brine stock are significantly correlated to the same measurements on green fruit. As fruit firmness, skin toughness, and carpel separation increase, the percentage of 'balloon bloaters' increases.

Rate of enzymatic softening can be reduced by low temperature storage. Thus, shelf life of firm, unpasteurized salt-stock pickles can be extended from 2 months at 86°F (30°C), to 4 months at 65°F (18.3°C), to 8 months at 50°F (10°C), to 16 months at 32°F (0°C).

Pasteurized Pickles

Market studies indicate that pickles should be crisp, green, and of a typical flavor. This applies particularly to fresh-packed pickles, which are the fastest growing segment of the pickle packing industry.

Cucumbers for pickling should be precooled promptly to a temperature of 50°F (10°C) and RH of 90% or higher and so held for not more than 4 to 6 days prior to pasteurization. Research in Holland has shown that 34 to 36°F (1.1 to 2.2°C) for 1 week is satisfactory for pickling cucumbers if they are processed promptly afterwards. Research in Arkansas has shown that pickling cucumbers will keep in acceptable condition for 2 weeks at either 34 or 40°F (1.1 or 4.4°C) in a controlled atmosphere (CA) of 3% O₂ plus 20% CO₂. Longer storage in CA resulted in off-flavor in the processed products. The longer the time between picking and packing without cooling, the greater is the loss of crispness and texture in the packed pickle.

Time and temperature of pasteurization need to be controlled very carefully, in relation to the quantity of pickles to liquid in the container. Before packing, it is again essential to cool the pasteurized pickles down to 70°F (21.1°C) or lower. If this is not done, the freshly packed product may go into the warehouse at 110 to 125°F (43.3 to 51.7°C), and remain at elevated temperature long enough to lose crispness, color, and flavor.

When cooled to 70°F (21.1°C) before warehousing, hermetically sealed pickles retain excellent quality for 1 year or longer if stored at 40°F (4.4°C). If stored at 86°F (30°C) or higher, they become soft and develop off-color and off-flavor.

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