

Peppers, Bell

Revised 2018

Thermal Properties

	English	Metric
Moisture, %	92.19	--
Protein, %	0.89	--
Fat, %	0.19	--
Carbohydrate, %	6.43	--
Fiber, %	1.80	--
Ash, %	0.30	--
Specific Heat Above Freezing	0.96 Btu/lb*°F	4.08 kJ/(kg*K)
Specific Heat Below Freezing	0.43 Btu/lb*°F	1.80 kJ/(kg*K)
Latent Heat of Fusion	132 Btu/lb	308 kJ/kg

Storage Conditions

	Temperature		Storage Period	Relative Humidity or Packaging	Freezing Point
	°F	°C			
Raw	45	7	2 weeks	90-95% with ventilation	30.5°F (-0.8°C)
Frozen	0 -10	-18 -23	1 year 2 years +	Vapor-proof packaging	
Dehydrated	75 36	24 2.2	6 months 1 year	Gas-tight, preferably vacuum packaging	
Canned	75 45	24 7	6 months 1 year +		

Raw Peppers

Bell peppers are subject to chilling injury (CI) at temperatures below 45°F (7.2°C). The thick-fleshed types seem to store better than the thin-walled peppers. Remove the red-colored peppers and those showing decay or mechanical injury. The optimum temperature is 45°F (7.2°C), and storage for 2 to 3 weeks should be possible. More ripening, evidenced by color change, will occur at 55°F (12.8°C) than at 50°F (10°C). No coloring takes place below 50°F (10°C). Ethylene does not significantly affect color change in bell peppers.

Temperatures below 45°F (7.2°C) usually predispose peppers to *Botrytis* and *Alternaria* decay, although peppers from some production areas are more tolerant of chilling temperatures. Sheet pitting, one of the manifestations of CI, begins to appear in 2 to 4 days on peppers stored at 32°F (0°C) and becomes serious in about 9 days on green bell peppers. Colored or red peppers are less susceptible to CI than mature-green peppers and colored ripe bell peppers likely can be held a week at 40°F (4.4°C) without injury.

Many bell peppers are waxed before shipping to reduce moisture loss and scuffing. Peppers must be held in high relative humidity (RH), with 95% considered optimum, otherwise they will gradually shrivel or become flabby. Film wrapping or carton liners can assist in maintaining a higher humidity around the peppers. Film-wrapped peppers develop less pitting when exposed to chilling temperatures than non-wrapped peppers, and they should have a storage life up to a week longer than non-packaged peppers. Some high-quality colored peppers are film wrapped.

Bell peppers are sometimes packed with no washing and room-cooled, but it is recommended that pre-cooling be accomplished by forced-air cooling, vacuum cooling, or hydrocooling. Shower hydrocooling is recommended over immersion hydrocooling. Hydrocooling by immersion may increase incidence of soft rot, even when the water is chlorinated, due to water infiltration into the pod.

Diseases and Injuries

Bacterial Soft Rot	Due to various common bacteria in conjunction with wounds. Control: Minimize physical damage; if using water, ensure strict sanitation.
Botrytis Gray Mold Rot	Early stages of decay are greenish and water-soaked, changing later to gray or grayish-brown. As spots enlarge, they become irregular with distinct demarcation between healthy and diseased areas. No objectionable odor. Disease likely to occur on peppers weakened by chilling injury or stored too long and/or at too low temperature. Control: Do not store at lower than 45°F (7.2°C) and 92 to 95% RH or for longer than the recommended period of 2 weeks.
Pythium Rot	Small water-soaked spots near the blossom end, enlarging rapidly. Diseased tissues becoming grayish-green, watery, soft, and slightly sunken. In later stages, slightly brown and covered with white cottony fungus growth. Favored by hot, wet weather. Control: No field control known. During wet weather, do not store peppers when showing water-soaked spots. Will spread to healthy peppers and develops very rapidly after removal from storage.
Rhizopus Soft Rot	More or less soft and watery, sometimes causing leaks. Under moist conditions, develops profuse white fungus growth known as 'whiskers' in which black spore masses are eventually found and which cause 'nesting' of the peppers. Fungus spreads rapidly by contact between healthy and diseased peppers in the center of moist containers. Control: Remove all injured, bruised, or decaying peppers before packing and refrigerate promptly at 45 to 50°F (7.2 to 10°C) to retard spread of decay.

<p>Chilling Injury</p>	<p>Symptoms are sheet pitting and surface scald on peppers, deterioration and decay of the calyxes, and the occurrence of numerous spots of <i>Alternaria</i> rot. Seeds may be discolored.</p> <p>Control: Do not store bell peppers below 45°F (7.2°C). Peppers stored at 41°F (5°C) will show chilling symptoms after 9 to 12 days storage.</p>
<p>Freezing Injury</p>	<p>Outer wall soft, flabby, water-soaked, dark green, with surface pitting following. With severe freezing, stems and stem caps often appear water-soaked and discolored and core and seeds turn brown.</p> <p>Control: Do not expose peppers to temperatures below 32°F (0°C).</p>

Preparation for Processing

Bell peppers are washed, inspected, and graded for color and size. The peppers may be fed by hand into an automatic coring machine which removes and ejects the stem, pithy placenta, and seeds and at the same time cuts the pepper into halves. The halves are washed under strong water sprays to remove any remaining seeds or pithy material. Some operators slice the top off the stem end and mechanically squeeze out the placenta and seeds. Other operators pass the whole pepper through rollers which crush the pepper and then remove the placenta and seeds by hand or by screening.

Bell peppers are processed either as whole green, in which case they are usually not blanched; cored and halved (un-blanched or blanched); or diced (un-blanched or blanched). Both green and red bell peppers can be processed un-blanched, but they frequently are blanched in water or steam for about 2 minutes to help preserve color and flavor and reduce bacterial and mold counts.

Freezing

Red, orange, or yellow (mature ripe) and green (immature, mature) peppers can be frozen. Some are packed in small 10-oz or 3-lb (283-g or 1.36-kg) cartons or polybags for the retail and food service market. Close to half are packed in 30- to 60-lb (13.6- to 27.2-kg) poly-lined cartons, while the rest are further processed as ingredients in canned or frozen products.

Rapid freezing methods, such as belt or fluidized bed freezers, are recommended for diced peppers because slow freezing for this item results in bleeding and adverse texture changes. It is preferable to remove the peppers from the boxes when blast freezing them; the quicker freezing resulting will reduce chances of damage and/or cracking. Storage at 0°F (-17.8°C) is adequate if peppers were blanched and are not intended for longer than 1 year in storage. At -10°F (-23.3°C) they can be stored for 2 years and longer.

Dehydration

Substantial quantities of diced bell pepper are dehydrated and marketed as such, usually for further processing, or further comminuted for use as a condiment. The more rapid the dehydration and the lower the temperature, the better the sensory and nutritional quality of the reconstituted product. Because of

cost, freeze-drying can be considered, and fluidized bed drying is preferable to other slower methods of dehydration. To maintain sensory and nutritional quality for 1 year, dehydrated peppers should be stored in cooler temperature of 36°F (2.2°C), and at even lower temperatures if they are to be stored for longer than 1 year.

Fresh-Cut Peppers

Minimally processed peppers (dices or slices) require lower storage temperatures than used for the intact peppers. For fresh-cut peppers, storage at 32 to 41°F (0 to 5°C) will give a shelf life of 7 to 10 days. Chilling injury of the cut peppers is not important. The same storage conditions apply to red or colored fresh-cut peppers. Modified atmosphere packaging with CO₂ levels between 5 to 10% will help reduce microbial growth.

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