

# Pumpkins and Winter Squash

Revised 2018

## Thermal Properties

	Pumpkins		Winter Squash	
	English	Metric	English	Metric
Moisture, %	89.76	--	87.78	--
Protein, %	0.95	--	0.80	--
Fat, %	0.13	--	0.10	--
Carbohydrate, %	8.59	--	10.42	--
Fiber, %	1.50	--	1.50	--
Ash, %	0.57	--	0.90	--
Specific Heat Above Freezing	0.95 Btu/lb*°F	3.97 kJ/(kg*K)	0.93 Btu/lb*°F	3.89 kJ/(kg*K)
Specific Heat Below Freezing	0.43 Btu/lb*°F	1.81 kJ/(kg*K)	0.45 Btu/lb*°F	1.87 kJ/(kg*K)
Latent Heat of Fusion	132 Btu/lb	306 kJ/kg	126 Btu/lb	293 kJ/kg

## Storage Conditions

	Fresh	Frozen Pulp
Temperature	50 to 55°F (10 to 12.8°C)	0 to -10°F (-17.8 to -23.3°C)
Relative Humidity or Packaging	50 to 70%	Vapor-proof packaging
Holding Period	1 to 6 mos., depending on cultivar	24 months at 0°F (-17.8°C) to 36 months at -10°F (-23.3°C)
Highest Freezing Point	30.5°F (-0.8°C)	

Winter squash and pumpkins are chilling sensitive and require moderate storage temperatures of 50 to 55°F (10 to 12.8°C) to avoid chilling injury (CI). If stored at 32 to 45°F (0 to 7.2°C), both pumpkins and squash develop CI and subsequently rot, mainly from *Alternaria*, during marketing. Development of *Alternaria* rot is the main symptom of previous exposure to chilling temperatures. The period required for CI varies, but generally for Acorn squash it is 15 to 20 days at 32°F (0°C), and 25 to 30 days at 40°F (4.4°C). In tests with six cultivars, Delicata was the most resistant to CI when stored at 45°F (7.2°C), while Butternut and Spaghetti were highly susceptible to CI. Some CI (increased decay) may occur after long-term (>2 months) storage of winter squash at 45 to 48°F (7.2 to 8.9°C). Therefore, storage at 50 to 55°F (10-12.8°C) is considered best.

Relative humidity (RH) recommendations range between 50 to 70%, with 60% identified as optimum, for pumpkins and winter squash. This is lower than for most vegetables. Higher RH may promote decay and lower RH causes excessive water loss and texture deterioration. Weight losses exceeding 15% should be avoided. In Butternut squash, weight loss above 15% leads to hollow neck, which is not evident externally but makes the squash inedible.

Approximate storage life at 50 to 55°F (10 to 12.8°C) for different cultivars follows: Table Queen (Acorn) 35 to 50 days; Quality, 80 days; Butternut, Connecticut Field and Cushaw, 60 to 90 days; and Hubbard 180 days or longer. Kabocha, Turban, and Butternut squashes can be stored at least 90 days. At higher temperatures 59 to 68°F (15 to 20°C), Table Queen will lose greenness, becoming undesirably yellow, and acquire a stringiness of the flesh in 5 weeks. All pumpkins and winter squashes should be well mature, clean, carefully handled, and free of injury and decay to store well. Hubbard squash should have the stems completely removed to avoid physical damage to the product during handling. A 15% loss in weight from shrinkage for 6 months' storage is about average.

Hubbard or other dark-green squash should not be stored with avocados, bananas, mangoes, or other ethylene-producing fruit with similar storage temperature requirements, as ethylene greatly hastens yellowing and senescence.

Pumpkins and winter squashes should be kept dry and supplied with good air circulation in storage. For prolonged holding on farms, storage in a single layer on slotted shelves, which provides free air circulation, is best. During distribution and in warehouses, storage in slatted bulk bins or crates is satisfactory. Disinfect storage shelves and containers periodically to avoid carrying disease organisms from one season to the next.

'Curing' of winter squashes and pumpkins at a high temperature of 80°F (26.7°C) before storage is no longer recommended, and it is actually harmful to some cultivars. However, Italian workers have had good success in storing Butternut for 5 months by placing them in a current of warm 79°F (26.1°C) air for 10 to 12 days before storage at 50 to 55°F (10 to 12.8°C). Wound healing after harvest can best be achieved by holding these vegetables for a week at 70°F (21.1°C) before cooling below 60°F (15.6°C) for storage. This may be accomplished by leaving the squash in the field under the plant leaves to protect from the sun.

## Diseases and Injuries

<p><b>Fusarium Rot</b></p>	<p>Brown spots with subsequent pinkish white mold.</p> <p><b>Control:</b> Avoid mechanical injuries, scratching and breaking. Maintain 50 to 55°F (10 to 12.8°C) temperature. Fusarium grows slower at lower temperatures.</p>
<p><b>Rhizopus Rot</b></p>	<p>Softening and water-soaking of flesh, which readily flattens but remains intact. Coarse, white mycelium forms in the tissues with black spores developing in air spaces. Flesh has slight sour odor and taste.</p> <p><b>Control:</b> Avoid bruising and mechanical damage. Maintain at 50 to 55°F (10 to 12.8°C).</p>

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<p><b>Alternaria Rot</b></p>	<p>Smooth tan lesions, which later develop into surface mold of greenish-black color. Lesions develop yellowish, fairly dry and spongy pockets to a depth of ½ inch (1.3 cm) beneath skin surface.</p> <p><b>Control:</b> Avoid chilling injury by avoiding 32 to 45°F (0 to 7.2°C) temperatures and maintaining at 50-55°F (10 to 12.8°C) during storage, transit, and marketing.</p>
<p><b>Black Rot</b></p>	<p>Infection occurs in field. Lesions at first are water-soaked, then greenish or grayish-brown, becoming firm and black as fruiting bodies form.</p> <p><b>Control:</b> Avoid storing infected or insect- and mechanically-damaged fruit. Control in field or carefully select disease-free fields for storage crop. Handle promptly at 50 to 55°F (10 to 12.8°C).</p>
<p><b>Bacterial Soft Rot</b></p>	<p>Water-soaking and pronounced softening at infection site. Infected fruit become soft and mushy and then hollow shells filled with liquefied tissues. Skin eventually ruptures, spilling seeds and contents. Odor is usually offensive. Soft rot enters via injuries and spreads rapidly at warm temperatures.</p> <p><b>Control:</b> Careful handling to avoid injuries and refrigeration during transit and marketing will help prevent losses.</p>

## Freezing

Fully mature pumpkins are washed, cut up, and the seeds and stringy material removed. The pieces are cooked by steam until the pulp is soft and easily removed from the shell. A pulper or finisher is used to break up the pieces and make a smooth, homogeneous paste. The paste is then cooled rapidly, packaged, and frozen. At 0°F (-17.8°C), frozen products can be stored for 24 months, whereas the storage period is extended to over 36 months with a storage temperature of -10°F (-23.3°C).

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