

# Beans, Snap

Also applies to Green Beans and Wax Beans

Revised 2008

## Thermal Properties

	English	Metric
Moisture, %	90.27	--
Protein, %	1.82	--
Fat, %	0.12	--
Carbohydrate, %	7.13	--
Fiber, %	3.40	--
Ash, %	0.66	--
Specific Heat Above Freezing	0.95 Btu/lb*°F	3.99 kJ/(kg*K)
Specific Heat Below Freezing	0.44 Btu/lb*°F	1.85 kJ/(kg*K)
Latent Heat of Fusion	130 Btu/lb	302 kJ/kg

## Storage Conditions

	Fresh	Frozen	Canned	Dehydrated
Temperature	40-45°F (4.4-7°C)	-5°F (-20°C) or below	40 to 45°F (4.4 to 7°C)	40°F or below (4.4°C)
Storage Period	8 to 12 days	1 year	1 year +	1 year +
Highest Freezing Point	30.7°F (-0.7°C)			
Relative Humidity	95-100%	Vapor-tight packaging		Air-tight vacuum packaging

## Fresh Storage

Snap beans, including green beans and wax beans, are occasionally cold-stored for processing or favorable markets. Snap beans can be held about 12 days at 40°F (4.4°C) if they are utilized immediately after storage, as for processing. Longer storage or higher temperatures hasten yellowing, seed

development, and toughening of the pods. At 45°F (7°C), snap beans in sound condition and refrigerated promptly should store satisfactorily for about 8 days.

Snap beans are susceptible to wilting, so the relative humidity should be maintained at 95-100%. Even free moisture is harmless unless the beans are exposed to unfavorably high temperatures. The danger of wilting due to lack of moisture exceeds that of discoloration attributable to free moisture. However, in consumer packages, the humidity around beans approaches saturation, so temperatures above 45°F (7°C) must be avoided or decay will likely be serious within a few days.

Snap beans should be hydro cooled rapidly after harvest, preferably to about 40°F (4.4°C). Water used for hydro cooling beans should contain 100-150 ppm free chlorine at pH 7, which minimizes transfer of decay and pathogenic microorganisms and reduces brown discoloration. Beans can also be effectively vacuum cooled and forced-air cooled, but hydro cooling is preferable because water not only cools more rapidly but the moisture helps prevent shriveling, especially for beans packed in wire-bound wooden crates, which tend to otherwise draw moisture from the bean pods. Hydro cooled beans packed in waxed fiberboard cartons had less mechanical damage when evaluated after 1 week storage than beans packed in wire-bound crates.

Snap beans may be severely chilled in a few days at temperatures below 37°F (3°C). Even the recommended 40 to 45°F (4.4 to 7°C) temperature may cause chilling injury on some varieties after 7 to 10 days. When snap beans are stored below 37°F (3°C) for 3 days or longer, chilling injury will cause surface pitting and russet discoloration to appear, especially in 1-2 days after removal to room temperature. Russetting usually is not apparent while beans are in cold storage. It is aggravated by free moisture and is especially noticeable in the centers of containers, where condensed moisture remains. Beans should not be top iced if they are to be held at higher temperatures later.

Snap beans are likely to heat in the hampers, crates, or sacks unless the containers are stacked so as to provide good aeration. If there is heating, there is likely to be loss of green color and increased decay. If beans are held in storage too long, or if they overheat, they may become slimy and moldy.

Snap beans do not benefit greatly from controlled atmosphere (CA) storage. The principal benefits that accrues from a combination of low O<sub>2</sub> (2-3%) and high CO<sub>2</sub> (5-10%) are retardation of yellowing and reduced brown discoloration and decay on damaged pods at 45°F (7°C). Air enriched with 20-30% CO<sub>2</sub> has been shown to be effective in inhibiting browning and decay of green beans during brief (24-hour) preprocessing storage periods.

## Diseases and Injuries

<b>Bacterial or Halo Blight</b>	<p>Small watery spots, gradually enlarging to irregular blotches varying in color from amber yellow to almost brick red around the margin. The centers of the diseased spots show an oozing of a greasy yellowish slime.</p> <p><b>Control:</b> Refrigerate beans promptly to <u>at least</u> 45°F (7°C).</p>
<b>Bacterial Soft Rot</b>	<p>Less frequent on snap beans than on other vegetables. Beans become affected only when wet and warm. Disease behavior and control similar to that of cabbage and celery.</p>
<b>Cottony Leak</b>	<p>Found especially on beans from Florida and the South, and especially during rainy weather. Large, water-soaked spots with much cottony, white mold, sometimes causing matting or nesting of beans.</p> <p><b>Control:</b> Remove all beans showing damage or disease at time of packing. Reduce temperature promptly to <u>at least</u> 45°F (7°C).</p>
<b>Rhizopus Soft Rot</b>	<p>Favored by moisture and high temperatures. Diseased tissues are soft and watery, losing moisture rapidly. White, stringy fungus growth, with shiny beads later turning black, which cause matting or nesting as it spreads.</p> <p><b>Control:</b> Discard all damaged and diseased beans before storage. Prompt cooling and refrigeration to <u>at least</u> 45°F (7°C).</p>
<b>Rust</b>	<p>Small brown spots, later with broken skin appearing as rusty-brown pustules, 1/16 to 1/8 inch (1.5 to 3 mm) in diameter.</p> <p><b>Control:</b> Selection of rust-resistant cultivars. Occurs only when humidity is high (95% or higher) and persists for at least 8 hours. Prompt refrigeration to <u>at least</u> 45°F (7°C) helps control.</p>
<b>Russetting (Chilling Injury)</b>	<p>Chestnut-brown surface discoloration that often develops in 1 or 2 days at room temperatures after 5 to 10 days storage at 32 to 40°F (0 to 4.4°C), not sunken and sometimes streaked.</p> <p><b>Control:</b> Moist warm beans develop russetting more rapidly, so prompt and adequate refrigeration helps control. Chilling injury can be minimized by holding beans at 45°F (7°C) after harvest, although general deterioration will be slower at 40°F (4.4°C).</p>
<b>Freezing Injury</b>	<p>Slight freezing causes water-soaked mottling. Severely frozen beans are completely water-soaked and limp and dry out quickly.</p> <p><b>Control:</b> Do not expose beans to temperatures below the highest freezing point of 30.7°F (-0.7°C).</p>

## Freezing

Snap beans may be frozen after packing in small consumer-size (9 to 16 oz; 0.25 to 0.45 kg) cartons or pouches. For bulk packaging, cut beans can be frozen loose, preferably individually quick frozen (IQF). The more rapid the freezing, the better the quality. However, there is little added value in cryogenic liquid immersion freezing over fluidized bed freezing, which gives definitely better results than the slower blast or contact freezing. Packaging should consist of material that is a good water vapor barrier. Small-size packages consist of a heavy gauge heat-sealed poly bag, or a carton overwrapped with heat sealed film. Bulk containers usually consist of cartons with inner film liners. If properly packaged, original quality level can be maintained for a year or longer in freezer storage at a temperature below -5°F (-20°C), and relative humidity in the freezer can be ignored. Frozen beans held at -13°F (-25°C) have a storage life of 2 years.

## Dehydration

The best quality of dehydrated green beans are obtainable by freeze-drying, which is also the most expensive method. In addition to maintaining organoleptic quality and ease of reconstitution, freeze-dried snap beans also retain nutrients almost as well as the frozen product, while air-dried snap beans lose more nutrients than frozen or canned snap beans.

As for other dehydrated products, snap beans must be packaged in water-vapor tight containers, preferably in vacuum, unless stored in freezer storage. Even if well packaged, however, to retain 90% of the original post-drying nutrients for 1 year, they must be stored in cooler storage at 40°F (4.4°C) or lower.

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