Lettuce

Revised 2018

Thermal Properties

	English	Metric
Moisture, %	95.89	--
Protein, %	1.01	--
Fat, %	0.19	--
Carbohydrate, %	2.09	--
Fiber, %	1.40	--
Ash, %	0.48	--
Specific Heat Above Freezing	0.98 Btu/lb*°F	4.09 kJ/(kg*K)
Specific Heat Below Freezing	0.39 Btu/lb*°F	1.65 kJ/(kg*K)
Latent Heat of Fusion	138 Btu/lb	320 kJ/kg

Storage Conditions

Temperature	32 to 34°F (0 to 1°C)
Relative Humidity	95 to 100%
Storage Period	Crisphead (Iceberg): 2 to 3 weeks Others: 10 days
Freezing Point	Crisphead (Iceberg): 31.3°F (-0.4°C) Others: 31.7°F (-0.2°C)

There are four types of lettuce: 1) solid crisphead (iceberg), 2) Butterhead, 3) Romaine, and 4) Looseleaf.

Lettuce is not usually stored, since significant quantities are continuously being harvested and marketed. Lettuce is also exported using modified atmospheres, and expected shelf life is 3 to 4 weeks. However, a temporary market surplus may result in short-term cold storage.

Most lettuce is now vacuum-cooled and shipped in fiberboard cartons. With dry-packed (naked) lettuce, high relative humidity (RH) in the storage room must be carefully maintained. If lettuce is packaged, the wraps or film liners must be adequately perforated or sufficiently permeable to water vapor to permit evaporation, or else proper vacuum cooling is impossible.

Damaged lettuce cannot be expected to store well, as crushed or broken leaves rapidly discolor and decay. Careful handling will prevent much of the damage. Lettuce in non-waxed fiberboard cartons should not be stacked more than six cartons high.

The average freezing point of lettuce is quite near the freezing point of water, 32°F (0°C). If lettuce is received for storage, it should be examined to ascertain that it is not frozen. Core temperatures should be taken in a random sample of boxes to make sure the lettuce has been pre-cooled to, preferably, between 32 and about 36°F (0 and 2.2°C) and no higher than 38°F (3.3°C), because palletized lettuce cools slowly.

Shredded Head Lettuce for salad bars and restaurants is more perishable than uncut lettuce and requires strict temperature control. It is usually packed with a light vacuum into moisture retentive film, which has been selected for a specific oxygen and carbon dioxide permeability. A modified atmosphere develops, which can extend shelf life by reducing browning, pink rib, and brown stain, as well as decay. These conditions work well if the correct temperature is maintained. Shelf life is 3 to 5 days at 50°F (10°C), 5 to 10 days at 41°F (5°C), 14 to 18 days at 36°F (2.2°C), and 21 days at 32°F (0°C). Shelf life is limited by development of decay, browning, and off odors.

For intact heads, modified atmospheres can provide some benefit. There is a narrow "window" of oxygen concentration which is beneficial. Oxygen above 3% has little effect on overall browning and respiration; however, levels under 1% may cause off flavors to develop. CO_2 can reduce some decay and discoloration at 5%, but greater amounts cause brown stain. Romaine lettuce is more easily damaged by CO_2 than iceberg lettuce. Overseas shipments sometimes employ controlled atmospheres to extend storage period to about a month. Temperature control as close as possible to 32°F (0°C) is still the major means to maximize storage life.

Diseases and Disorders

Bacterial Soft Rot	Soft, mushy tissues often confined to outer leaves and sometimes following tip-burn or other primary lesions. **Control:** Ascertain that heads are free of field infections of soft rot because once established it spreads even at recommended storage temperatures.
Downy Mildew	Light green or yellowish spots scattered on the upper surface of older leaves, on the lower leaf surface, beneath these spots a very obscure white mold, secondary invasion by other microorganisms. **Control:** Nothing can be done except store at recommended storage temperature.
Gray Mold Rot	Water-soaked, somewhat grayish-green or brownish areas without odor. Later characteristic grayish-brown fungus and spore masses. **Control:** Destruction of plant trash in field and refrigeration are the only control measures.
Rib Discoloration	Light brown to black, oblong areas usually discolors the inner surface of the midribs, commonly where veins branch off. Cause is unknown, but high temperatures during growth favor its development. **Control:** None known.

Tip Burn	Widely distributed physiological disease, usually confined to more actively growing young inner leaves and not always readily seen. Starts with small, yellowish, translucent areas or spots near leaf margins, later turning brown, with darkening of the leaf veins. Under drying conditions, margins become papery. Sometimes followed by bacterial soft rot, if temperatures are higher than recommended. **Control:** No postharvest control is possible. Rapid growth and/or unequal distribution of water within plant favor development. Field control, to some extent, is possible.
Watery Soft Rot	Soft, watery, leaky decay, usually first on stem and lower leaves, light or pinkish-brown without characteristic odor. White fungal growth with scattered irregular, bluish-black particles. **Control:** Field control is essential, followed by proper refrigeration.
Russet Spotting	A postharvest physiological disorder of head lettuce characterized by numerous small tan to brown or olive spots principally on the midribs of leaves, which increase in number with the storage period. Worse at 38°F (3.3°C) than at 32°F (0°C). Induced by ethylene, but also can occur in virtual absence of ethylene contamination. **Control:** Maintain temperature near 32°F (0°C). Move lettuce as quickly as possible. Do not store in same room with ethylene-producing products, such as apples, pears, cantaloupes, peaches, Honeydew melons, etc. It is recommended to use only electrically powered forklifts in storage; internal combustion engines give off ethylene. Holding in low O_2 atmospheres (about 2 to 6% O_2) reduces russet spotting development, but the key control is to avoid ethylene exposure.
Pink Rib	A physiological disorder of crisphead lettuce that develops in storage, particularly in hard, over-mature heads, characterized by light to dark pink discoloration of larger midribs. This discoloration is not caused by bruising. **Control:** Keep temperature near 32°F (0°C). Avoid prolonged storage (>2 weeks).
Brown Stain	A physiological disorder of crisphead lettuce characterized by lesions that are about ¼ inch (6.4 mm) wide by ½ inch (12.7 mm) long. Their margins often are darker than their centers, giving a halo effect. Caused by carbon dioxide gas (CO_2) and aggravated by low O_2 and added carbon monoxide (CO). **Control:** Do not hold intact lettuce heads where CO_2 concentrations might exceed 2%. Shredded and salad cut lettuce are less sensitive to CO_2 injury.

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