Grapes, American and European

Revised 2024

Thermal Properties

	American		European	
	English	**Metric**	**English**	**Metric**
Moisture, %	81.30	--	80.56	--
Protein, %	0.63	--	0.66	--
Fat, %	0.35	--	0.58	--
Carbohydrate, %	17.15	--	17.77	--
Fiber, %	1.00	--	1.00	--
Ash, %	0.57	--	0.44	--
Specific Heat Above Freezing	0.89 Btu/lb*°F	3.71 kJ/(kg*K)	0.88 Btu/lb*°F	3.70 kJ/(kg*K)
Specific Heat Below Freezing	0.49 Btu/lb*°F	2.07 kJ/(kg*K)	0.52 Btu/lb*°F	2.16 kJ/(kg*K)
Latent Heat of Fusion	117 Btu/lb	272 kJ/kg	116 Btu/lb	269 kJ/kg

Storage Conditions

	European (Vinifera)	American
Temperature	30 to 31°F (-1 to 0°C)	31 to 32°F (-0.5 to 0°C)
Relative Humidity	90 to 95%	85 to 90%
Storage Period	2 to 6 months	1 to 2 months
Rachis Freezing Injury Point	30°F (-1°C)	

European (Viniferous) Grapes

The European (Viniferous) grape varieties are an important cold storage item. Since these types of grapes have a high sugar content, their freezing points are comparatively low, near 28°F (-2°C). However, the freezing point of the rachis, or stem, is somewhat higher than that of the berries, and they cannot be safely stored at temperatures below 30°F (-1°C). Storage at this temperature reduces both mold development and quality deterioration.

Grapes should be pre-cooled promptly after harvest. This is best done in separate rooms with large refrigeration capacity, high air velocity, and high relative humidity. Most grapes are pre-cooled in forced-air coolers.

Relative humidity in storage rooms should be in the 90 to 95% range, and air movement should be from 50 to 75 linear feet per minute (15 to 23 meters/minute). Pallets are usually stacked 2 or 3 high in lanes designed to maximize the use of space while allowing sufficient air movement between pallet lanes. If fumigation is used, air movement is increased to disperse the sulfur dioxide and provide uniform concentrations throughout the storage facility. High humidity slows drying of the rachis and shriveling of the berries.

Emperor, Calmeria, Red Globe, Crimson Seedless, and Ribier varieties are stored longest, but large quantities of Thompson Seedless, Flame Seedless, Flame Tokay, Perlette, Princess, and Cardinal are stored for shorter periods. Storage quality is related to seasonal weather to some extent, and grapes picked after rain are more subject to decay than those not so exposed.

The use of sulfur dioxide (SO_2) gas is practiced to control mold in storage or in packages as generators, and it also helps to maintain the green appearance of the rachis. Such fumigation is discussed elsewhere in this Manual under **Grapes, Fumigation with Sulfur Dioxide**.

A decay forecasting technique is helpful to segregate grapes of good storage potential from those likely to develop a high percentage of decay.

American Grapes

American grape varieties are not well suited to long storage and will not keep well, even under optimum conditions, for more than 3 to 4 weeks. “Catawba” is the best storing variety, although “Concord” is most widely produced. “Muscadine” grapes are rarely stored. Usually, quality deterioration is rather rapid in storage, and excessive decay develops in a short time. American grape varieties cannot be fumigated with SO_2 because of their greater sensitivity to SO_2 injury.

High humidity, low temperature, and low air velocity are desirable to keep the fresh appearance of the rachis and to keep the berries from shriveling. Careful handling is imperative because injured grapes decay readily.

Diseases and Injuries of Grapes

Black Mold Rot	Black, watery, leaky, odorous decay, usually in the center of the bunch, with purplish-brown, powdery spore masses. This mold is often associated with bunch rot. **Control:** Develops in the field. Careful handling and prompt refrigeration to 39°F (4°C) or below prevents the disease in storage. Fumigation with SO_2 helps control.
Blue Mold Rot	Characteristic blue-green mold with soft, watery, and mushy diseased tissues with moldy odor and flavor. Often mold growth covers stems. **Control:** Prompt refrigeration to 39°F (4°C) or below, preferably 32°F (0°C) or very slightly below, and treatment with SO_2.

Gray Mold Rot	In early stage, no mold growth may be evident, but skins of grapes slip off easily, later fairly firm decay with much gray mold and grayish-brown velvety spore masses, nesting or matting tendency, especially in wet, cool seasons. When grapes are regularly fumigated, the surface mold does not develop, but the berries decay from within, forming mummies. **Control:** Cull out decayed berries when packing. Treatment with sulfur dioxide will control spread of decay and spore germination but will not kill infections present when the grapes are packed. Refrigerate promptly to recommended storage temperature. Do not store for long, if at all, grapes harvested after rain or slight freeze. Grapes harvested after rain should be fumigated as soon as possible. It is not necessary to surface-dry "Emperor" grapes before fumigation.
Cladosporium Rot	On long storing varieties, like Emperor, black, firm decay, often affecting only one side of the grape. The grape becomes flattened and wrinkled, sometimes with olive-green mold growth. **Control:** Grows slowly at 32°F (0°C). The use of sulfur dioxide helps to control.
Almeria Spot	Found on Almeria (Ohanez); surface spots are faint purple or gray and slightly sunken. Flesh spots are brown and resemble drought injury in prunes. "Almeria" grapes have been largely replaced by the Calmeria, variety which is less subject to this disorder. **Control:** None. Not due to cold storage.
Rhizopus Rot	Soft, mushy, leaky decay, causing discoloration of lug boxes. Decayed tissues may show coarse white mold with glistening white, but later black spore masses. **Control:** Careful handling and culling of injured grapes and prompt cooling to 45°F (7°C) or below at which temperatures the mold cannot grow.
Cracking	Found especially on Ribier, Flame Seedless, Red Malaga, and Tokay varieties, among others, shallow cracks, the skin usually curling inward followed by mold which may show up in storage. **Control:** None. Not due to cold storage.
Freezing Injury	American types grapes show milky, opaque pulp and shriveling. Purple varieties undergo no color change, but red or green varieties may show slight browning. European varieties when frozen are dull-colored, soft, and flabby, and may become wet and sticky. Stems freeze before the berries do and at first are water-soaked, later turn dry and darken. **Control:** Avoid exposure to freezing temperatures.

Sulfur Dioxide Injury	Grapes that are immature, warm, or cracked are injured most readily if the sulfur dioxide concentration exceeds permissible limits. Injury may appear either as bleaching of the skin, especially around the cap-stem attachment, or cracks or as dull color without bleaching. Bleached areas are sunken or depressed in many cases. Injured berries tend to turn brown when removed from storage. Ribier and Alicante Bouschet are quite resistant, but Red Malaga, Tokay, and Emperor are rather susceptible to injury. Sulfur dioxide injury symptoms on all varieties are increased or aggravated as the storage period is extended. **Control:** Follow the proper recommended procedures for fumigating grapes with sulfur dioxide (total utilization system).
Sun Scald	Tan to sometimes dark brown leathery spots in parts of the bunch exposed to intense sunlight and heat. Most common in Flame Tokay, but also found in Emperor, Calmeria, Princess, and Thompson Seedless. **Control:** None. Not due to cold storage. Injured fruit should be culled out before cold storage.
Water Berry	Soft and watery, but not due to decay, although secondary invasion of decay fungi may occur. Cause not known but is physiological in origin. Malaga, Thompson Seedless, Emperor, and Flame Tokay are most susceptible. In Zinfandel, Cornichon, and Mission, "Red Berry" resembles water berry, except that grapes are red colored instead of the normal blue-black or black. **Control:** None. Not due to cold storage.

Freezing for wine production

Wine grapes can be frozen and yield a greater quantity and quality of juice and/or wine. To prevent undesirable changes during frozen storage for several months, 100 ppm SO_2 may be added to the crushed grapes before freezing.

Because of changes in registration of chemicals for postharvest application, operators should seek current registration information in their region. All chemicals must be used in accordance with registration provisions and may not be allowed on fruits destined for certain markets.

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