Blackberries & Raspberries

Also applies to Boysenberries, Dewberries, Loganberries, and Youngberries

Revised 2008

Thermal Properties

	Blackberries		Raspberries	
	English	**Metric**	**English**	**Metric**
Moisture, %	85.64	--	86.57	--
Protein, %	0.72	--	0.91	--
Fat, %	0.39	--	0.55	--
Carbohydrate, %	12.76	--	11.57	--
Fiber, %	5.30	--	6.80	--
Ash, %	0.48	--	0.40	--
Specific Heat Above Freezing	0.93 Btu/lb*°F	3.91 kJ/(kg*K)	0.95 Btu/lb*°F	3.96 kJ/(kg*K)
Specific Heat Below Freezing	0.46 Btu/lb*°F	1.94 kJ/(kg*K)	0.46 Btu/lb*°F	1.91 kJ/(kg*K)
Latent Heat of Fusion	123 Btu/lb	286 kJ/kg	124 Btu/lb	289 (kJ/kg)

Storage Conditions

	Fresh		Frozen	
Temperature	31 to 32°F (-0.6 to 0°C)		0°F (-18°C)	-10°F (-23°C)
Relative Humidity	90-95%		NA	NA
Storage Period	Raspberries	2-5 days	18 months with sugar 12 months without sugar	24 months with sugar 18 months without sugar
	Blackberries	2-5 days		
Highest Freezing Point	30.5°F (-0.8°C)		NA	NA

Fresh Berries

Raspberries and blackberries are highly perishable and are not adaptable to prolonged cold storage. Limited quantities of berries are now machine harvested for processing. Removal of field heat from the berries immediately after harvest is essential. If left in the sun they may rapidly soften and red raspberries may scald or bleach. Post harvest cooling, ideally within one hour of harvest, should be to 32°F (0°C) and refrigeration should then be continuous from producer to consumer. Rhizopus and Botrytis can cause complete decay in a few days when berries are held at 45°F (7°C) or above.

Blackberries and red, black or purple raspberries can be held only 2 to 5 days at 31 to 32°F (-0.6 to 0°C) with 90 to 95% relative humidity. Red raspberries gradually darken and become bluer if stored 8 days. It should be noted that storage at 32°F (0°C) results in less color change than at 40°F (4°C). All handling and transport must be extremely gentle to avoid damage. Some pallets of berries after forced-air cooling are now enclosed in 5-mil polyethylene pallet cover and gassed with carbon dioxide before shipment to market. About 15-20% CO_2 is recommended for raspberries and blackberries to retard softening and decay during refrigerated transport by air or truck or during holding for subsequent processing. Sometimes dry ice is used to supply the CO_2 gas. If CO_2 exceeds 25%, off-flavors and loss of red color in internal tissues can develop in these berries.

Diseases and Injuries

Cladosporium Mold	Olive-green color, superficial on either inside cup of berry or outside, causing little or no flesh decay, but makes the fruit unacceptable for marketing. **Control:** Careful handling and prompt cooling and shipment at as close to 32°F (0°C) as possible.
Gray Mold Rot (Botrytis)	Decayed berries are soft and watery; decay occurs during storage or transit rather than in the field. Nesting of berries is characteristic with grayish brown spore masses. **Control:** Careful handling, culling out decayed berries before packing. Prompt cooling to 32°F (0°C) and storage at a temperature as near 31 to 32°F (-0.6 to 0°C) as possible.
Rhizopus Rot	Mushy, leaky collapse of berries associated with black mycelium. Extensive red staining of containers from leaking juice. **Control:** Reduce temperature promptly to 32°F (0°C). Handle carefully to prevent skin breaks.

Frozen Berries

Red raspberries packed for the retail trade are packed in a 50-60% syrup at the rate of 6 oz (168 mL) of berries to 4 oz (112 mL) of syrup. Ten and 16 oz (275 and 448 mL) containers are used for this trade.

Packaged fruit may be tray-frozen on carts, which are put into the freezing tunnel, case frozen, or in some instances, pallet frozen.

For the bakery and preserve trade, the berries are packed in 30 lb. (13.6 kg) plastic containers or tins, or 55 gal (250 L) drums with and without sugar according to the specifications of the purchaser. The filled containers are frozen by air blast and are stored at 0°F (-18°C).

Black raspberries are almost entirely packed in 30 lb. (13.6 kg) plastic containers or tins, or larger containers. Following are some guidelines for handling and freezing berries in large containers for the baking and preserve industry.

1. Field heat removed so that temperature of fruit fill will not exceed 40°F (4.4°C); although lower temperatures would be better.
2. Containers should be moved to freezing and storage as quickly as possible, preferably within 1 hour after being filled.
3. Product should arrive at the freezing location at temperature of 40°F (4.4°C) or lower and be unloaded and moved to the designated freezing area within 30 minutes.
4. Quick-freeze at -15°F (-26°C) or lower with high air flow so as to attain 32°F (0°C) or less at center of container within 2 days (48 hours).
5. The product should remain in freezing area until a core temperature of 0°F (-18°C) is reached and this should not take longer than 2 to 5 days depending on container size and freezing load capability.
6. Subsequent storage should be at 0 to -10°F (-18 to -23°C).
7. Storage period normally does not exceed 14 months at 0°F (-18°C) for top quality berries packed and handled in large containers.

These practices are adhered to for the following purposes, listed in order of importance:

1. Microbiological population - It is very important to keep these counts (mainly yeast, mold, and lactobacilli bacteria) as low as possible in that they will affect grade (Howard mold count) and quality, such as flavor.
2. Texture - Rapid freezing reduces the size of the ice crystals formed which helps greatly in maintaining the integrity of the fruit and reduces enzyme activity on pectins. Integrity of the fruit is very important in the production of high quality jams and preserves.
3. Flavor - Quick freezing gives a more normal, typical flavor and greatly reduces the risk of off-flavors due to microbial or enzymatic activity or loss of volatile esters.
4. Color - Retention of color is enhanced by faster cooling and freezing by reducing enzymatic color degradation.
5. Nutrition - Loss of vitamins (mainly vitamin C) is reduced by quick cooling and freezing.

Added sugar will influence the freezing rate and quality in two ways. First, if the sugar draws out moisture to form a liquid medium around the berries, the freezing rate would be faster since heat transfer is faster through a semi-liquid medium than it would be through air spaces surrounding dry berries.

Secondly, the freezing point would be lowered and ice crystal formation would be delayed and reduced in size, thereby reducing the time required to reach temperatures below 28 to 32°F (-2.2 to 0°C) This is because the high energy requirement needed to pass through the Latent-Heat Zone (liquid to solid-ice crystal formation) would be delayed until after the product is below temperatures conducive to microbial growth. Thus, the reduced size of the crystals would have a favorable influence on wholeness and the reduced microbial growth would improve the other quality parameters discussed.

Some companies are using liquid high fructose corn syrup (HFCS) rather than dry sugar for freezing their fruit stock. High fructose has 71-80º Brix and may be used at a ratio of 4 parts fruit to 1 part HFCS. The HFCS may be rapidly absorbed by the fruit, and may result in improved firmness, wholeness and color during freezing and storage.

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