

HEAT-RELATED FRUIT DISORDERS AND SUNBURN SUPPRESSION

SUNBURN

Sunburn is a major cullage source, with field estimates ranging between 8 and 12%, but actual damage frequently exceeds these figures. Warehouse packouts have shown cullage from sunburn to be as high as 40%.

Type I Sunburn

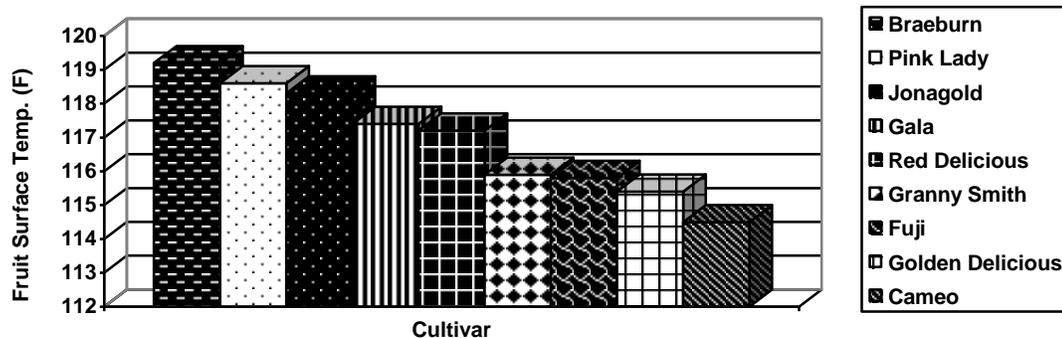
Type I, known as sunburn necrosis, is induced on the sun-exposed side when surface temperatures reach 126 ± 2 F° for as little as 10 minutes. Thermal death of cells occurs and cell contents leak through cell membranes. Fruit tissue appears black and a flat lesion often develops.

In Washington, sunburn generally occurs during the hours of 3:00 p.m. and 4:30 p.m. in July and August. This is when temperatures are usually at their highest.

Type II Sunburn

Sunburn browning (Type II) occurs at lower fruit skin temperatures and is a non-lethal event. Browning is induced when the sun-exposed side of an apple exceeds its “threshold temperature” for approximately 1 hour. Threshold temperature are cultivar specific and reflected in the graph below.

* Larry Schrader, WSU TFREC, Wenatchee (experimental induction)



‘Braeburn’ and ‘Pink Lady’ has the highest threshold temperatures and ‘Cameo’ has the lowest.

Type III Sunburn

Only recently was this “new” form of sunburn described. Type III sunburn occurs when unacclimated fruit is suddenly exposed to elevated levels of heat and/or light. It is a common and sometimes severe problem late in the season as temperatures cool and fruit lose their tolerance to light & heat stress. Fruit in this state that is exposed to the sun by tree training, repositioning, or simply by sitting in bins at harvest, may show a bleaching of its colors, followed by browning. This disorder may even show up after fruit goes into storage.

SUNBURN SUPPRESSION

Evaporative Cooling (EC)

EC is the most effective technique for sunburn suppression, but it is expensive and can leave hard water stains on fruit. EC works by applying water which cools the air and fruit surface as it evaporates. EC also reduces other heat-related disorders like lenticel marking, stain, water core, sunburn scald and bitter pit.

Surround

Surround is widely used across the state, and is the standard to which other sunburn protectants are compared. Surround is highly refined kaolin clay and was the first viable commercial product for sunburn

suppression. Surround is a dusty material which irritates some workers, even though it is safe. Fruit covered with Surround can be difficult to color-pick, and some warehouses struggle to clean Surround residues from their fruit and dump tanks.

Raynox

Raynox is a waxy matrix that was developed by Dr. Larry Schrader (WSU, Wenatchee). Raynox is clear and leaves no visible residue. The current formulation of Raynox is not calcium-compatible

Eclipse

Like Surround, Eclipse coats fruit with a reflective white film. Unlike Surround, it is made from finely ground limestone and is easier to clean off fruit at harvest.

HEAT-RELATED FRUIT SURFACE DISORDERS

Heat and light stress have been correlated with many other fruit disorders which may appear pre-harvest or later in cold storage.

Lenticel Breakdown Disorder

Lenticel breakdown disorder is a major problem on Gala & Fuji. Has a high incidence in heat-stress fruits, and may be exacerbated by soaps in packing houses. Lenticel breakdown disorder has become a high research priority in the state of Washington

In the 1990's, as the volume of Gala and Fuji increased, they were stored for increasing lengths of time. Some lots of fruit developed sunken, brown spots around lenticels within a day of packing. The fruit often had no symptoms when being packed.

Fuji Stain

Fuji stain is a peel disorder that limits marketability and is associated with heat-stress. In storage, affected fruit develop a brown-green discoloration on their sun-exposed flanks.

Water Core

Water core is caused by an osmotic gradient which takes up excess water into fruit with high levels of sugar. It is generally seen in overripe fruit or fruit that is picked late season when temperatures are warm in the day and cool at night. Water core diminishes storage life, forcing water cored fruit to be quickly marketed

Delayed Sunburn Scald

Scald is induced by pigment degradation. There can be two causes: too much chlorophyll in the flesh and peel, and high temperatures (above 80F) during harvest. Traditionally Washington growers wait until the scald-sensitive varieties such as Red Delicious accumulate 150 hours below 50F before harvesting. If the weather is very warm during harvest, increased scald should be anticipated. 1-MCP is effective for scald control in Red Delicious and Granny Smith. DPA can be thermofogged into CA rooms in December to provide additional scald control.

Bitter Pit

Bitter pit is typically attributed to an internal imbalance of calcium & nitrogen. However, bitter pit is often aggravated by other nutrients, excess vigor, hot weather at harvest, poor cooling in the warehouse, and lightly cropped trees. Calcium sprays can reduce the incidence of bitter pit if calcium is deficient in the soil.