

appearing apples. *Control:* Use controlled atmosphere at 38 to 40 F for Yellow Newtowns and other susceptible varieties.

Jonathan Spot

Slate-brown to black, entirely superficial or very slightly sunken, skin-deep spots in color-bearing cells of skin. In some varieties the spots center at lenticels. *Control:* Refrigerate promptly as this disease is greatly aggravated by delayed storage. Use controlled atmosphere storage.

Lenticel Rots: Bullseye rot (*Neofabraea*); Fisheye rot (*Corticium*); and Side rot (*Phialophora*)

Bullseye rot most common of group; of importance only from Northwest; spots fairly firm, pale centers, decay mealy, may penetrate nearly as deep as wide. Fisheye rot, tough leathery spot, often follows scab, decayed tissue stringy. Side rot, spots shallow with tender skin, decayed tissue wet, slippery. *Control:* Harvest at prime maturity; store and cool promptly; use forecasting technique for Bullseye rot to determine potential keeping quality.

Scab (*Venturia*)

Occasionally active scab spots on fruits at time of storage will enlarge. Fruits may be infected in orchard but show no disease at time it is put in storage. Disease may subsequently develop in storage as small brown or jet black spots in peel, often without breaking cuticle of fruit. *Control:* Follow recommended spray schedule.

Scald

Diffuse browning and killing of skin of fruit stored for several months. Ordinarily most prevalent on immature fruit or on green portions of fruit. *Control:* Pick apples when well matured. Treat with Santocin. Packing with $\frac{1}{2}$ lb oiled paper per bushel will delay appearance of scald.

Soft Scald

Sharply defined or ribbon-like slightly sunken areas in the skin. Affected tissue shallow and rubbery. Most severe on Jonathan and Rome Beauty. *Control:* Store promptly. Hold apples in CO₂ atmosphere for 2 days during cooling period. If apples are particularly susceptible, store at 36 F.

Soggy Breakdown

Light brown, moist, rubbery, definitely delimited areas in cortex of apple. Not visible on surface. Worst in Grimes Golden, Wealthy, and Golden Delicious. *Control:* Same as for soft scald.

Water Core

Hard, glassy, water-soaked regions in flesh of apple at core or under skin. Decreases in extent during storage but predisposes fruit to internal breakdown. *Control:* Pick as soon as mature. Watch fruit in storage and move before becoming overripe.

APRICOTS

See Peaches because diseases are alike for these two fruits.

AVOCADOS

Anthracoze (*Colletotrichum*)

Scattered black spots covering firm decayed tissue that can be removed easily from surrounding flesh. Pink spore masses form on spots under moist conditions. *Control:* Prevent blemishes and other breaks in skin.

Flesh Darkening

General dulling or graying of flesh color, particularly around base of seed. Also darkening of fibers throughout the flesh. Darkening is sometimes a varietal characteristic; at other times, a result of storage at too low temperature. *Control:* Store hard or firm fruit at 45 to 55 F depending on variety. Ripe fruit may be held safely as low as 32 F.

BANANAS

Anthracoze (Ripe Rot) (*Gloeosporium*)

Shallow black spots on stems of ripening fruit. Under moist conditions pink spore masses cover center of spots. Dark dis-

coloration of skin may extend from stem ends over entire fruit. *Control:* Protect fruit from mechanical injury. Damage reduced by polyethylene bagging. Schedule ripening so that fruit is consumed before appearance of defect.

Black Rot (*Thielaviopsis*)

Transmitted via fibrovascular system of plant from wounds. Progresses into crowns and stem ends of fingers. Produces brownish-black areas in peel at fruit ends. As fruit ripens skin becomes grayish-black in color and water soaked. Pulp rarely affected. *Control:* Paint freshly cut tips and butts of fruit stalks with fungicide paste in Tropics. Avoid mechanical injury and maintain sanitation program from Tropics to ripening room.

Chilling Injury

Dull gray color in skin with increased tendency to darken upon slight bruising. Latex in green fruit does not bleed freely and will be clear rather than cloudy. Subsurface peel tissue streaked with brown. Turning or ripe bananas more susceptible to injury than green fruit. *Control:* Avoid temperatures below 55 to 56 F. Moving air makes occurrence of chilling more rapid.

Rhizopus Rot

Extensive soft rot of split and broken fruits; prompt development of coarse mold bearing white and black spore cases. Commonly observed in ripening rooms. *Control:* Load carefully in ships and railway cars to avoid bruises and bruising of fruit.

CHERRIES

Alternaria and Cladosporium Rot

Light brown, dry, firm decay lining skin breaks, that can be removed easily from surrounding healthy tissue. Mycelium on area fine and white above and dark green below. *Control:* Sort out cherries with cracks and other skin breaks at packing.

Blue Mold Rot (*Penicillium*)

Circular, flat spots covering conical soft, mushy decay that can be scooped out cleanly from surrounding healthy flesh. White fungus tufts turning to bluish-green develop on surface. Musty odor and flavor. *Control:* Prevent skin breaks. Market promptly. Refrigerate promptly to 32 F.

Brown Rot (*Sclerotinia*)

See Brown Rot of Peaches. *Control:* Follow recommended spray practices. Refrigerate promptly to 32 F. Package cherries in polyethylene bags to reduce desiccation of stem and fruit, preserve color and reduce decay development.

Gray Mold Rot (*Botrytis*)

Light brown, fairly firm, watery decay covered with extensive delicate dirty-white mycelium. On completely decayed cherries grayish-brown velvety spores may be found. *Control:* Handle carefully. Refrigerate promptly to 32 F.

Pullularia Rot

Thin extensive decay over surface of cherry causing it to become sticky. *Control:* Refrigerate promptly to 32 F. Handle carefully.

Rhizopus Rot

Extensive soft, leaking decay with little change from normal color. Coarse mycelium and black spore heads are prominent under moist conditions. More prevalent in upper-layer packages in refrigerator car. *Control:* Rhizopus develops very slowly at temperatures below 50 F so storage at recommended temperature keeps decay in check.

CITRUS FRUITS

Citrus fruits include grapefruit, oranges, lemons, limes, and tangerines.

Aging

Small to large sunken, drying, discolored, firm areas in skin around stem button or on the upper part of fruit. *Control:* Pick before over-mature. Avoid overheating in packing house treatments. Wax fruit. Store for limited period only in fairly high relative humidity, 85 to 90 percent. Store limes at 42 F or above.

Diseases and Deterioration of Products

Alternaria Rot

Usually at stylar end in oranges as a black, dry, deeply penetrating decay. In lemons as a slimy, leaden-brown storage decay of core starting at stem end. *Control:* Provide optimum growing conditions. Harvest oranges before overripe. Do not store tree-ripe lemons. Restrict storage period for other lots known to be weak. Green buttons are an indication of strong fruit. Treatment of lemons at the packing-house with 2-4-D or 2-4-5-T in wax emulsion or in water improves resistance of lemons to disease.

Anthracoze (*Colletotrichum*)

Small, scattered, leathery, dark brown, sunken spots. Internal affected tissues dark gray, fading through pink to normal color. *Control:* Keep trees healthy. Prevent skin breaks. Store for short periods only.

Blue (and Green) Mold Rot (*Penicillium*)

Soft, watery, decolorized lesions which under moist conditions become quickly covered with blue or olive-green powdery spores. *Control:* Prevent skin breaks. Use antiseptic washes. Cool fruit to as near 32 F as is practicable. Use biphenyl in box liners or in fruit wraps.

Brown Rot (*Phytophthora*)

Extensive firm, brown decay having a penetrating rancid odor. Chiefly on fruit from California and Arizona. *Control:* Submerge fruit at packing for 2 minutes in water at 115 F.

Freezing Injury

Field freezing is found scattered through boxes. Transit and storage freezing is worse in exposed fruits in bottom-layer boxes or those nearest cooling coils. Affected fruits may show water-soaked areas in rind. Internal tissue disorganized, water-soaked, milky, and with rind flavor. Frozen fruit loses moisture, causing drying, separation of juice vesicles and buckling of segment walls. The freezing point of citrus fruits is about 29 F.

Internal Decline

In lemons, core tissues near stylar end break down and dry, becoming pink. *Control:* Maintain optimum moisture conditions in grove.

Pitting

Pitting is a physiological disease manifested by depressed areas of $\frac{1}{8}$ to $\frac{1}{4}$ in. diameter in the peel of citrus fruits. Affected tissues collapse and may appear bleached or brown. Pits occur anywhere on the fruit, and may coalesce to form large irregular areas. The cause is not fully understood. In general it is a low temperature disorder. *Control:* See recommended storage temperatures in Chapter 48.

Stem-end Rot (*Diplodia*; *Phomopsis*)

Pliable, fairly firm, extensive, brown decay starting at stem. Characteristic, sour, pungent odor. Prevalent in Florida and found occasionally in Arizona and California fruit. *Control:* Dip harvested fruit promptly in 8 percent borax solution or other proven antiseptic. Use wraps or box liners treated with biphenyl. Cool promptly below 50 F.

Stylar-end Breakdown

In Persian limes, large, gray to brown area of sunken, drying skin at stylar end. *Control:* Pick before fruit is too mature.

Watery Breakdown

Soft, spongy, water-soaked condition of entire fruit after storage at low temperature. Resembles severe freezing injury but affected fruits are scattered throughout packages, have pronounced objectionable flavor, and are completely waterlogged. *Control:* Use recommended time and temperature for storage of each kind of citrus fruit.

CRANBERRIES

Chilling Injury

Affected berries tough, rubbery, with pink color diffused throughout interior. *Control:* Store berries at 36 F or above.

Fungus Rots (Several Fungi)

Limited portions or entire berry brown, soft, and collapsed. Some berries turned into "water bags." *Control:* Spray in field. Handle carefully. Reduce temperature to 38 to 40 F after harvest.

GRAPES

Blue Mold Rot (*Penicillium*)

Watery, mushy condition. Early production of typical bluish-green spores on berries and stems. Moldy odor and flavor. *Control:* Prevent deterioration in fruit by careful handling and prompt refrigeration, preferably to 32 F. Fumigate with sulfur dioxide in storage.

Gray Mold Rot (*Botrytis*)

Early stage, slip skin, with no mold growth. Later, nest of fairly firm decay covered with abundant fine gray mold and grayish-brown, velvety spore masses. *Control:* Cull out decay when packing. Fumigate grapes with SO₂. For storage, cool grapes rapidly to 31 or 32 F. Use forecasting technique to determine safe storage periods. Use short storage period for grapes harvested during rainy periods or following slight freezes.

Rhizopus Rot

Soft, mushy, leaky decay causing staining of lugs. Coarse extensive mycelium and black sporangia develop under moist conditions. *Control:* Prevent skin breaks. Cool promptly to below 50 F.

Sulfur Dioxide Injury

Bleached sunken areas on berry at skin breaks or cap-stem attachment. Decolorized portions have disagreeable astringent flavor. Does not appear in full severity until cool grapes are warmed. *Control:* Apply proper concentration and distribution of gas for recommended period.

MANGOES

Anthracoze (*Colletotrichum*)

Large scattered black spots in the skin of ripening fruits. Under moist conditions pink spore masses develop in spots. *Control:* Control disease on tree by regular spraying.

PEACHES

Anthracoze (*Glomerella*)

Circular, brown, slightly sunken spots $\frac{1}{8}$ to $\frac{1}{4}$ in. in diameter. Cream colored or pink sticky spore masses in the center of the larger spots. Found chiefly on fruit from the southeast United States. *Control:* Use orchard sprays. Carefully grade out all spotted fruit at packing time. Refrigerate promptly.

Brown Rot (*Sclerotinia*)

Extensive firm, brown, unsunken, decayed areas turning dark brown to black in center and generally covered with dusty spore masses yellowish-gray in color. Skin clings tightly to center of old lesions. *Control:* Control disease in the orchard. Prevent punctures caused by insects and otherwise. Refrigerate promptly to as near 32 F as feasible.

Cold Storage Injury

Fruit loses flavor, becomes dry and mealy. Breakdown starting around pit is grayish brown, water-soaked or mealy. *Control:* Refrigerate promptly to 31 to 32 F. Breakdown appears earlier at 36 to 40 F. Store only for 2 to 4 weeks, depending on variety.

Pustular Spot (*Coryneum*)

Common on peaches from West, occasionally on Eastern fruit. At first small purplish-red spots, later up to $\frac{1}{4}$ in. in diameter, brown, sunken with white center. *Control:* Control with orchard sprays. Cool harvested fruit to below 45 F.

Rhizopus Rot

Extensive fairly firm, watery decay with uniformly brown surface color. Skin slips readily from centers of lesions. Coarse mycelium; black spherical sporangia develop under moist conditions. *Control:* Store cannery peaches at 32 F before ripening. Prevent skin breaks. Cool promptly to below 50 F.