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CHAPTER 51

DISEASES AND DETERIORATION OF PRODUCTS

Hazards of Spoilage Before and During Storage; Recognition and Control of Diseases; Handling, Temperature, and Humidity Requirements for Maintaining Quality

FRUITS and vegetables often carry fungus spores and bacteria on their surfaces at harvest. Under certain temperature and moisture conditions these organisms may cause disease. The extent to which decay is initiated or to which incipient infection develops into active decay in storage depends largely on the condition of the commodity, the rate of cooling, and the period of holding. Proper temperature and moisture during storage slow aging or ripening and minimize decay, both by keeping the product vigorous and by slowing the rate of development of the organism. Many fungi, however, even under optimum conditions for the product, can slowly develop and cause decay during a long storage period.

In addition to diseases caused by fungi and bacteria, there are many diseases which are not caused by pathogens but are due to physiological disturbances. These include diseases such as apple scald, Jonathan spot of apples, and mahogany browning in potatoes. Many of these disorders are closely related to temperature conditions. Some are induced by slow rate of cooling; others are brought on by temperatures that are too low, yet not freezing.

The quality of each lot of produce should be determined at time of storage and regular inspections should be made during storage. Such vigilance will permit early detection of disease so that, if necessary, the affected commodity can be moved out of storage before serious loss develops.

The brief statements concerning fruits and vegetables which follow have been prepared to apprise warehousemen of the hazards of spoilage during storage and to aid in the recognition and control of diseases. Only the most important diseases are discussed. Detailed information on most of the diseases, indicated as numbers in superscript following the name of the commodity reference, may be obtained by consulting the references listed at the end of this chapter.

The scientific name of the causal organism is given in parentheses following the common name in order to help the reader to identify references to the diseases in scientific literature.

APPLES

Alternaria Rot

Dark brown to black, firm, fairly dry to dry storage decay centering at wounds, skin cracks, in core area, or in scald patches. One of the blackest of storage decays. *Control*: Cultural practices that produce apples of good finish; prevent skin diseases and injuries that open way for infection.

Ammonia Gas Discoloration

Circular spots centering at lenticels; dull green on unblushed side and brown to black on blushed side. Injury may disappear from slightly affected fruits. *Control*: Ventilate as soon as possible. Examine fruit for injury at various points in room because some sections may escape.

Bitter Pit

Numerous small, sunken bruise-like spots, usually on the calyx half of the fruit. Masses of brown, spongy tissue occur adjacent to surface pits or may be found deeper in the flesh. In storage spongy tissue near surface loses moisture and tends to become hollow. New areas may appear and develop in storage. *Control*:

Follow cultural practices that promote regular bearing, and stabilize moisture. Store fruit of proper maturity and cool promptly to 32 F. Maintain humidity high enough to prevent moisture loss.

Blue Mold Rot (*Penicillium*)

Spots of various sizes with decayed tissue that is soft, watery, and can be readily scooped out of the surrounding healthy flesh. Rot usually as deep as wide. Advanced stages have white tufts of mold which turn bluish-green as spores are produced under moist conditions. Affected tissue has moldy or musty flavor and odor. Most important storage decay of apples. *Control*: Handle carefully to prevent skin breaks. Cool promptly to 32 F. Keep picking boxes, packing house, and storage room sanitary. White-wash walls and ceiling.

Brown Core

No external symptoms. First appears as slight browning or discoloration of core tissue between the seed cavities. Later a part, or all, of the flesh between the seed cavities and the core line may become brown. Serious in McIntosh and other susceptible varieties stored for long periods at 30 to 32 F. *Control*: Pick at proper stage of maturity. Use controlled atmosphere storage at 38 to 40 F. A disorder with similar symptoms has been reported as a result of exposure to excessive concentrations of carbon dioxide.

Bullseye Rot (See Lenticel Rots)

Cork

Strictly an orchard disease that does not develop in storage. Large masses and streaks of firm, dead, brown tissue deep in flesh and around the core. Surface of apple may be bumpy. Areas larger than spongy tissue of bitter pit. *Control*: Follow recommended cultural practices. Apply borax to soil around trees that produce apples with internal cork.

Freezing Injury

Watersoaked, rubbery condition of large areas or of entire apple. Vascular (water-conducting strands) brown. Bruised areas in frozen apples large, with wrinkled gray to light brown surface. Moisture lost rapidly from affected areas. In refrigerator cars most prevalent on floor, at doorways and bunkers; in storage room most injury in bottom layer boxes, near coils, or against walls next to freezer storage. *Control*: Heat car during sub-freezing weather. Prevent cold pockets in storage rooms by adequate air circulation. Handle fruit as little as possible while frozen. Thaw at 40 to 50 F. Move thawed fruit into trade channels promptly; do not allow it to become overripe.

Internal Breakdown

Mealy breakdown of internal tissue in overripe fruit. Flesh soft. Surface often duller and darker than normal. Hastened by too high storage temperature, freezing, bruising, or presence of watercore which it often follows. *Control*: Pick before overmaturity. Cool promptly at temperatures as near 32 F as possible for varieties that tolerate that temperature. Watch rate of ripening, particularly of fruit with watercore.

Internal Browning

No abnormal skin appearance. Sometimes appears only around core; the outer fleshy portion of the apple remains normal in appearance. Occasionally only outer flesh is involved; usually, however, when internal browning develops in outer fleshy portion it is accompanied by browning around the core. Disease develops uniformly throughout tissue. Occurs in firm, sound-