

Calcium Helps Prevent “Bad Apples”

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Ever have apples that exhibited abnormalities on the surface or in the flesh that did not appear to be caused by a disease, insect or mechanical injury? If so, more than likely the fruits were suffering from a physiological disorder. Apples are subject to several physiological disorders that can develop during the growing season and/or after harvest when they are being stored. These disorders include cork spot, bitter pit, Jonathan spot, water core, internal breakdown and storage scald, and their symptoms are described as follows:

Cork spot develops during the growing season, and is characterized by localized greenish to brown depressions on the fruit surface with brown, corky areas (“spots”) in the flesh. The corky spots in the flesh may develop just under the skin in association with a surface depression, or they may be deeper in the flesh and not associated with a depression. These symptoms are more prominent on the calyx half of the fruit. The spots in the flesh have a bitter taste. Under severe conditions, fruit cracking can occur.

Bitter pit can occur late in the growing season or in storage. It is very similar to cork spot, but the areas of brown, corky, dead tissue is confined to areas just under the skin.

Jonathan spot can occur late in the growing season or in storage. It is characterized as small, brown to black spots on the skin that may or may not be sunken. The spots develop most frequently on the sun-exposed side of the fruit, and are often associated with lenticals (dots). The flesh under the spot has

a water-soaked appearance, and does not develop an off-flavor.

Water core occurs before harvest, and is characterized as translucent, water-soaked areas in the flesh. These water-soaked areas commonly develop near the core, but in severe cases, can radiate out to the skin. Fruit with water core are edible, and may have a sweeter flavor, but their storage life is reduced. Mild cases of water core can disappear in storage.

Internal breakdown is a storage disorder that is characterized by a browning of the flesh and eventual softening and disintegration of the fruit. All fruit will eventually develop internal breakdown with its onset being associated with senescence and the potential storage life of a cultivar. However, its premature development can be a serious problem.

Storage scald is a disorder that results in a brown discoloration of the skin during storage. It is usually only a problem when fruit are stored for a long period of time. Fruits that develop storage scald are edible, but not very attractive.

Apple cultivars exhibit differences in susceptibility to each of these physiological disorders. Cork spot, bitter pit and Jonathan spot appear to be a cultivar-related expression of the same basic disorder with cultivars susceptible to one disorder not develop symptoms of the other two disorders. Although the symptoms of these disorders differ, they have two common characteristics. First, larger sized fruit are more prone to these disorders than smaller sized fruit. Second, they have all been associated with low levels

of calcium in the fruit. Because of this characteristic, they are often collectively referred to as calcium-related physiological disorders. Blossom-end rot of tomatoes is a similar calcium-related physiological disorder.

Calcium is an important mineral nutrient affecting fruit quality. One of its roles is in maintaining cell wall integrity and bonding between cells by combining with soluble pectin to form insoluble calcium pectate. As a result, fruit with high levels of calcium are firmer and have longer potential storage life. Its second role appears to be as a "safening agent" that deactivates undesirable by-products of fruit metabolism.

Although most Iowa soils are high in calcium, its uptake by plants is closely related to the soil moisture supply, with roots being unable to take up calcium whenever the soil becomes either too wet or too dry. Because almost all the calcium transport into apple fruit occurs during the cell division phase fruit development, which lasts from four to six weeks following bloom, such wet or dry periods during the spring greatly increase the risk for developing one of these calcium-related physiological disorders.

Commercial apple growers have adopted the use of foliar calcium sprays as a standard practice to reduce the incidence of these calcium-related physiological disorders using either calcium chloride (70% flake) which can burn the foliage and is corrosive to spray equipment, or other safer calcium-containing products such as STOP-IT or Nutri-Cal*. To be effective these calcium-containing products must be deposited on the fruit because very little calcium deposited on the leaves is translocated to the fruit. These products are applied beginning with the first or second spray after petal fall and are continued

through the growing season until sufficient calcium has been applied. Generally, this is five to eight applications per year to reduce the incidence of these physiological disorders. Research has shown that more applications are required to improve the firmness of apples.

Although low fruit calcium has been associated with these physiological disorders, calcium sprays alone will not eliminate the problem. A total cultural management program* is required to effectively control these physiological disorders. Such practices include:

- Planting apple trees on well-drained sites and irrigating during periods of drought.
- Controlling nitrogen fertilization to avoid excessive vegetative growth and oversized fruit.
- Moderate pruning to maintain a proper balance between vegetative growth and fruiting.
- Taking measures to promote a normal crop from year-to-year such as bees for pollination and fruit thinning to avoid biennial bearing.
- Harvesting at the proper time. Apples harvested too early are more prone to storage scald, while those harvested late are more prone to bitter pit, Jonathan spot, water core, and internal breakdown.
- Applying foliar calcium sprays in years when unfavorable soil moisture conditions develop in the spring, or whenever the trees have had a history of one or more of these calcium-related physiological disorders.

* Now available through Earl May Garden Centers.