

COMMON FRUIT DEFECTS

07 A GUIDE TO
BEST PRACTICES



COMMON FRUIT DEFECTS

In order to assist operators throughout the distribution chain to identify defects and be able to report these correctly and in a consistent manner the following can be considered:

FRUIT SOFTNESS

When checking fruit for softness, hand pressure is often used. However, this is subjective, and therefore an alternative is a penetrometer, which is designed to penetrate the fruit after a certain pressure is applied. A typical instrument sold for use on avocados has a tip of 1/4 inch (6mm). To measure a fruit, select an area on the equator of the fruit (ensure there is no bruising or damage to the fruit) and using a blade or knife remove the exocarp (skin). Apply the penetrometer tip to the fruit and gently press the instrument so that the tip penetrates the fruit. At the point where the line on the tip is level with the fruit flesh, take the pressure reading. There will be variation within any consignment of avocado fruit, both within a box and within a pallet. Therefore, a number of readings must be taken, and an average calculated. This can be used as a guide as to the overall softness of the fruit, but due to known variation, is not definitive. The softness category is described as follows:



CATEGORY	PENETROMETER AVERAGE (PSI)
Hard	>25
Firm	15-25
Breaking	10-15
Firm-ripe	5-10
Eating ripe	<5

VISUAL EVALUATION OF EXTERNAL FRUIT QUALITY

A sample of 10 fruit is used. The degree of defect is rated on a 0-10 scale as a % of the surface affected, where 1= 10% of surface affected and 10 =100% of surface affected. The score of the 10 fruits are then added, and the total is the % defect of the composite sample.



EXTERNAL DEFECTS

Fruit color has been used for many years as a marketing tool for Hass avocado fruit, indicating to the final consumer when fruit is ripe and ready to eat. However, the degree of black coloration and intensity of color does differ within season and fruit origin, depending on maturity and climatic conditions. Therefore, color is not a good determinant of fruit quality, and should not be used.



Defect: Ridging

Ridging is usually due to some form of damage very early in fruit development, possibly even during flower development. While it may be weather or insect related, an extensive raised portion of the fruit may be genetically linked. Ridges may be seen as a clearly raised portion normally longitudinally down the fruit, of varying width, and the fruit may also be misshapen. Ridges are prone to general abrasion while fruit is on the tree, by for example leaves rubbing the area when fruit is very small. Additional damage could occur during picking, transporting and packing. Internal quality is not likely to be affected, but visually the fruit may be unattractive to buyers.



Defect: Sunburn

Sunburn is most notable as an area of hard, corky or cracked skin that may be of light yellow to reddish brown or even black in color, usually only on one side of the fruit and often towards the stem end. The flesh below the damaged area is usually also damaged and will not ripen normally. Sunburn is most prominent on exposed fruit especially at the top of trees and notably where leaf coverage is sparse.



Defect: Lenticel Damage

Lenticels are the pores of outer plant tissue that provide a direct exchange of gases between internal plant tissues and the atmosphere. Lenticel damage is characterized by black and collapsed lenticels. After extended periods of storage, particularly at low temperature, the initially small areas of damage often enlarge as the cells around the lenticels dehydrate, become more susceptible to low temperature damage and therefore also collapse and die. Unless extensive, much of the lenticel damage becomes hidden by the dark background color of ripe Hass fruit. Lenticel damage usually has little effect on internal quality.

Lenticel damage is primarily caused by abrasion during handling, usually during picking and transport to the packing house, as well as on the pack line. Fruit dumping onto the line, especially if dry dumped, and the action of brushes during washing or cleaning are major causes of the physical damage.

The rougher the fruit, the more likely the lenticels will be damaged. In addition, if the fruit is very turgid, lenticels will be more subject to damage. Trees should therefore not be irrigated the day before picking, and preferably, fruit should not be picked or transported if it is cold and wet.



Defect: Chilling Injury

Chilling injury is indicated by well defined areas of black, sunken lesions. These may vary from small to large extensive areas of the fruit surface. Often, one side of the fruit is more extensively damaged, and the distal (bottom) end of the fruit is often worse. The lesions do not penetrate into the fruit flesh, although in severe cases internal chilling damage may also occur. In the absence of internal damage, internal quality will not be affected, but the external damage may encourage development of post harvest fungal diseases.

The primary cause of chilling damage is the use of initial cooling as well as storage and shipping temperatures that are too low. Less mature early season fruit is more susceptible, as is fruit from trees high in nitrogen and low in calcium. In addition, the longer the shipping period, especially if temperature is too low, the more extensive the damage. If initial cooling is too fast, excessive air flow over fruit surfaces can result in enhanced damage, especially if this also results in fruit water loss and if lenticel damage is also present. The solution is careful use of the most appropriate cooling and shipping protocols taking fruit maturity and origin into account.

**Defect: Thrip Damage**

Thrip damage usually occurs early in fruit development, and is the result of the insect removing the top layer of the fruit skin. Scar tissue forms in these areas, resulting in areas of rough, corky brown scar tissue on the fruit surface which will not color with ripening. Because the damage usually occurs early in fruit development when fruit are small, the eventual result may be extensive fruit surface damage. A good pest monitoring and control program is essential. Internally, fruit are usually not affected, making the defect mainly cosmetic.

**Defect: Limb Rubs (Scarring)**

Lines of brown corky, scarred skin which will not color on ripening, are the result of physical damage, most notably when the fruit is small. The fruit skin can be damaged by leaves or branches rubbing against the fruit. The use of windbreaks can substantially reduce the incidence. Generally, this is confined to external blemish, with little to no effect on the internal quality of the fruit.

**Defect: Copper Sulfate Residue**

Copper sulfate is extensively used in many production areas to decrease orchard fungi which cause post harvest diseases such as stem end rot and anthracnose. This may leave visible blue-green spray residue, which does not in any way adversely affect internal quality or food safety, but may be unacceptable to consumers. Fruit washing and brushing on the pack line will help to remove this, but may not always be successful. Certain formulations of copper sulfate which are easier to remove are available.

**Defect: Checkerboard Ripening**

Checkerboard ripening refers to boxes of fruit where the fruit colors and ripens at different rates, such that the fruit within a box varies from green to varying shades and intensity of black as well as variable softness. Some fruit may never color entirely, resulting in a green to brown color even when fully ripe. While the internal quality will not be seriously affected, it is a considerable problem for fruit ripeners as it is difficult to predict ripening rate and shelf life within a consignment. The most likely cause is the packing of variable maturity fruit, most likely where there are multiple fruit set periods in a season and older, more mature fruit is mixed with younger less mature fruit.

INTERNAL DEFECTS

Where fruit are evaluated for internal defects, the number of fruit within a 10-fruit sample with the defect is reported. This can also be expressed as a %.



Defect: Diffuse Flesh Discoloration

Diffuse flesh discoloration presents as a diffuse grey to black or sometimes brown coloration of the fruit flesh, which may be visible in hard fruit which has been stored or shipped but intensifies as fruit ripens. The discoloration also intensifies with time after fruit is cut. Internal fruit quality is poor, becoming increasingly so as the discoloration intensifies. The discoloration is due to the presence of dead fruit flesh tissue, which affects taste in addition to appearance.

There are multiple potential causes for the disorder, which include internal chilling injury, especially if the fruit is less mature, incorrect gas concentrations during controlled atmosphere shipping (particularly low oxygen or high carbon dioxide) or fruit that has been stored or shipped for very long periods, especially late season fruit. Fruit that starts ripening during shipping is especially prone to the disorder. Fruit from trees high in nitrogen and low in calcium are also more sensitive to the factors that cause the disorder.

Defect: Flesh Bruising

Flesh bruising is shown by an area of grey to black flesh usually on one side of the fruit extending from the seed towards the skin, and often around the middle section of the fruit. The defect is most notable when the fruit is ripe. There may be no other noticeable internal defect. Bruising is an indication of rough handling, which may occur at any time from harvesting onwards. Although hard, unripe fruit is susceptible, and only shows symptoms later after ripening, the most sensitive stage for bruising occurs once ripening begins, and is therefore particularly important in the retail sector. Rough handling, stacking of fruit too high in displays and repeated customer handling to test ripeness are important factors.



Defect: Grey Pulp

Grey pulp is a more intense form of diffuse flesh discoloration. The grey to black coloration of the flesh is particularly intense in the distal (bottom) area of the fruit, but may also extend towards the stem end. Vascular discoloration may sometimes accompany the symptom.

There are a number of potential causes, but the disorder is particularly noted in more mature fruit towards the end of the harvest season. Length of storage plays a notable role, with longer storage or shipping times significantly increasing the potential for the disorder. The temperature of storage or shipping is also important. Especially notable, is the effect of temperatures that are slightly too warm, allowing the fruit to start ripening during the shipping or storage. The presence of ethylene during a slow, low temperature fruit ripening, which would occur under these conditions, is known to enhance the problem.

Fruit from trees high in nitrogen and low in calcium are more prone to the disorder.



Defect: Flesh Adhered to Seed

When fruit is cut in half and pulled apart, sometimes a portion of the flesh adheres to the seed. The cause is uneven ripening, where some of the fruit, especially at the top of the seed, does not ripen properly, and remains hard and rubbery, while other portions of the fruit ripen normally and therefore separate from the seed easily. The disorder is more prevalent in early season less mature fruit. Incorrect ripening temperature (temperature too high) may enhance the problem. Fruit quality is affected, in that some of the fruit ripens normally while other portions remain unripened.

**Defect: Stem End Rot**

Stem end rot appears as translucent to brown discoloured area in the fruit flesh, starting from the stem end and progressing downwards through the fruit. Where severe, white fluffy or pinkish fungal mycelium may also be present. Externally, a black clearly decaying zone around the stem end may be present, although in early stages of development no external symptoms may be seen. At early stages of development, there may or may not be vascular discolouration accompanying the disorder. The cause is a group of fungi present in the avocado trees in the field. Dead branches within the trees are a particular source of the fungal spores which infect the fruit. Warm, wet conditions also increase the presence of the pathogens. Fruit become infected mainly at the time of harvest, the fungi entering through the cut fruit pedicels. Picking wet fruit increases the chance of infection, and less mature fruit are also more susceptible. Growth of the fungi tends to be suppressed by low temperatures, but increases rapidly once fruit start ripening.

The most common control measures involve preharvest fungicidal sprays (mostly using copper formulations) to decrease fungal presence, and removal of dead wood from trees. Postharvest fungicides are only partially effective.

**Defect: Vascular Browning**

Vascular browning is indicated by distinctly visible dark brown to black vascular tissue in cut fruit. The dark colored vascular tissue follows the vascular tissue from the stem end through the fruit to the distal (bottom end) of the fruit where it enters the seed. The disorder is often associated with an internal chilling damage due to long storage periods at temperatures too low for the maturity of the fruit (symptoms more noticeable around the distal end of the fruit), or with stem end rot (symptoms extend more clearly from the stem end).



Defect: Stem End Rot & Vascular Browning

In many cases, fruit shows symptoms of both vascular discolouration and stem end rot. This is particularly the case with advanced decay (with the exception of stem end rot caused by one fungal group).

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Internal defect photos courtesy of Salvador Ochoa Ascencio