HS140

UF UNIVERSITY of FLORIDA
IFAS Extension

Tree and Fruit Disorders[1]

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Although the majority of the disorders are seldom seen, a few commonly occur and cause reductions in fresh fruit pack-out each year.

Over the years certain key criteria have been found useful in determining the probable causes of blemishes, most importantly their appearance. Many blemishes have characteristic damage patterns, colors, or roughness that can be used for diagnostic purposes. The time of injury can usually be determined from the appearance of the blemish at harvest. Often, this is the first time the grower or packer notices such disorders.

SURFACE INJURIES

Many surface injuries to citrus fruit are emphasized by the development of a wound periderm that forms after injury. Sometimes, as the fruit continues to grow, the dead tissue above the periderm bleaches and breaks into patches. With very early injury, the wound tissue is completely sloughed off before fruit maturity, whether injuries are shallow, such as those caused by rust mite, or deeper injuries resulting from hail damage. Therefore, the degree of bleaching, patching, and sloughing is a guide to how early the injury occurred.

DEPTH OF INJURY

The depth of the injury is also important. Both hail and chewing insects will cause deep wounds, while citrus rust mite, spray burns, and wind scar result in very shallow injuries. When injured areas are raised rather than depressed, it is usually an indication of a fungal pathogen; i.e., scab or melanose. However, not all pathogen-associated blemishes are raised. For example, although greasy spot does not cause raised lesions, early Alternaria induced lesions on tangerines are initially raised but later develop into depressions due to loss of corky tissue.

BLEMISH COLOR

The cause of a blemish can be indicated by the abnormal color of the rind. Blemishes which are dark to light brown involve peel necrosis and occur late in the fruit development period. Some disorders result in rind areas greener than normal as in delayed color break, scale spots, green stink bug feeding, greasy spot, and regreening. This usually means that chlorophyll synthesis was stimulated by a toxin or gibberellin synthesis, or that chlorophyll breakdown was inhibited.

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BLEMISH LOCATION

The cause of a blemish can also be indicated by its specific location on the fruit. For example, greasy spot (pink pitting) occurs only between the oil glands because it destroys only a limited number of cells beneath the stomates. Conversely, rust mite usually causes injury over the entire surface; however, on grapefruit, late rust mite injury can also be located mostly between the oil glands. When this happens, it may be difficult to decide whether the blemish was caused by rust mites or greasy spot. The observation of one or more small punctures near the center of the blemish area, especially when there is necrosis, is good evidence of insect feeding or thorn damage.

CULTURAL CONCERNS

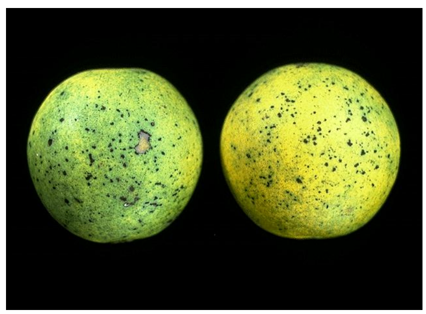
There are several steps the grower can take to avoid losses from peel blemishes in fresh fruit blocks. The first major consideration is that less than 1/10 of the orange crop and 1/2 of the total grapefruit crop are used annually in fresh fruit channels. Considering this, each grower should select an appropriate number of grove blocks, based on good past histories of high pack-out, for a fresh fruit program. These are likely to be mature groves with wide driving middles. Large trees are less likely to have a high incidence of wind scar, and wide middles will minimize damage to lower fruit from equipment travel. Hedged rows perpendicular to prevailing wind directions will result in lower wind scar damage. Cultivating across the grove in very narrow middles is a practice that leads to heavy damage to lower fruit. All blocks selected for fresh fruit should receive a moderate fertilizer program to avoid green color retention, rough peel, and accentuation of blemish problems. A well managed irrigation program will avoid prolonged dry or wet periods which can also contribute to many peel disorders.

The grower should be aware that both climatic conditions and grove practices prior to harvest influence the ability of the fruit to withstand rough handling during or after harvest. Uniform and adequate soil moisture is considered important to avoid several stress-related blemishes. Maintenance of good fertility programs is also important as nutritional imbalances such as high nitrogen and low potassium levels can lead to increased creasing and plugging at harvest.

SPRAY INJURY

Determination of the actual set of circumstances leading to fruit spray injury is often difficult. Attempts to duplicate symptoms in the field by spraying the suspect chemical(s) usually fail as actual conditions at the time of application are seldom if ever similar. Variables include stage of development and positioning of fruit, rate and type of spray application (dilute or concentrate), spray additives including oils and surfactants, and environmental conditions including temperature and humidity. Evidence for the cause of fruit injuries can be found in the location of the injured fruit as it hangs on the tree. In the spring when small fruit are positioned with the styler end facing outward, surface spray accumulation is likely to be on the bottom side of the fruit rather than at the styler end. On larger fruit which are usually hanging down, spray accumulation will be more likely at the styler end. Therefore, at maturity, the damaged area may not be in the position originally affected when the spray was applied. The lower spray-accumulating surface of the fruit in the spring later becomes turned toward the tree canopy surface as it pivots downward due to the fruits' increased weight.

dilute.



concentrate.

Location of the affected fruit within the canopy also can provide valuable information in determining the causes of blemishes. If the affected fruit are predominantly on the sun-exposed side of the tree, damage may be from spray burns associated with climatic stress or damage caused by climatic stress alone. Damage to fruit located only at the top or inside of the tree canopy may indicate poor spray coverage, and damage only on bottom fruit may indicate fertilizer or herbicide contact burn. Dilute spray applications are more likely to cause large burns due to spray droplet accumulation while concentrate sprays will result in more numerous smaller blemishes distributed over the surface area onto which the spray impinged. Certain pesticides and combinations of pesticides are more likely to cause burns than others, with the chances for injury increasing at higher spray concentrations under high heat stress conditions in the presence of spray additives such as oils and surfactants. Contaminated water supplies and pH extremes may also be implicated. Gross errors occasionally occur when, for example, herbicides are placed in spray tanks resulting in serious tree damage and fruit loss.

PEST MANAGEMENT CONCERNS

Of vital importance in minimizing blemish losses after fresh fruit blocks are selected is adequate pest monitoring and timely scheduling of spray applications. Blocks should be examined frequently for insects and mites that can cause blemishes. Even citrus rust mite can be adequately controlled on the basis of careful and frequent monitoring programs which will reduce unnecessary sprays. Of particular importance is the proper timing of fungicide sprays in fresh fruit blocks. This can be accomplished even with a number of large grove blocks and a minimum amount of spray equipment if the fresh fruit blocks are predetermined and given priority. Blocks of processing fruit can then be sprayed at the beginning and end of the time period considered most suitable for control. Sprayers providing good coverage should be used in fresh groves when equipment options are available. Spray material sequences that will lead to pest upsets should be avoided. A good example would be sulfur dusts and sprays which disrupt parasite populations. To reiterate, the choice of spray materials is of importance in minimizing blemish incidence. Some combinations and individual compounds present risks in a fresh fruit program. A sulfur application too close to an oil spray is very likely to cause a burn. Liquid copper formulations have also been shown to occasionally result in fruit blemishes. Ethion and oil combinations, applied as concentrate sprays under extremely hot summer conditions, have been associated with spray burn leaf drop and twig damage. Generally, oil tends to increase the phytotoxic potential of any compound because it increases the penetration of chemicals through the stomatal pores and plant cuticle. Mixing untested combinations of materials in spray tanks and applying these mixtures as concentrate sprays involve risks that growers should not take on potential fresh fruit blocks. When liquid chelated nutritionals are mixed with other sprays and/or oil, particularly as concentrate sprays, and applied to young fruit during the post bloom period, spray burns have sometimes resulted.

SPRAY APPLICATION

Much of the spray damage that occurs to fruit could be substantially reduced were more attention paid to directions on product labels and recommendations in the current *Florida Citrus Pest Management Guide*. Particular importance should be attached to specific application procedures and precautionary measures with respect to timing and concentrations of sprays, spray additives and environmental conditions. Fewer products in the tank usually reduce the chances of damage. Then, if damage does occur its cause can be more easily identified.

Keeping spray mixes simple is both prudent and cost effective as in many cases products in the tank are either not required or not effective at the time of application.

BROWN GUM SPOTS

This type of injury usually occurs on the lower surface of leaves which are exposed to direct sunlight. Leaves which are not mature are particularly susceptible under high heat stress conditions. This condition may also occur as a result of slight frost injury. Usually only a few leaves are affected, but sometimes when the weight of a heavy crop is removed from the tree resulting in changes in positioning of branches, a high percentage of leaves may be affected due to exposure of previously shaded surfaces.

The spots are irregular in shape with hard raised surfaces surrounded by a bleached appearance. The surface layers of cells are impregnated with a hard gumlike material. The spots are much larger than those typical of melanose lesions. They also should not be mistaken for greasy spot which is more likely to occur on both sides of the leaf midrib than confined to one side as is characteristic of this condition. Similar brown, greasy spotlike blotch areas observed on the upper leaf surface of certain mandarin hybrids, particularly Sunburst, have been associated with late summer mite damage and heat stress.

CHIMERAS

A genetic mutation occurring in a branch or twig of a tree may survive and develop into a new twig with characteristics different from the rest of the tree. This is known as a chimera or "sport." Resulting fruit may be abnormal in shape or rind texture or have different rind or flesh color. Rind abnormalities may be confined to sections of the fruit surface. Such mutations may also affect the shape, size or color of the leaves. Some of the cultivars today have been propagated from such chimeras, although generally such sports produce inferior quality fruit and should be avoided as propagation material.

chimera.

fruit.

TREE COLD INJURY

The extent of cold injury to citrus depends on a number of factors, and its expression may occur over an extended period of time. Factors involved include type of freeze, location, tree dormancy, tree vigor, scion and rootstock, crop load and grove and soil conditions.

Citrus is essentially not injured unless ice is formed in the tissues. Ice in the leaves is indicated by dark water-soaked areas on the surface. Such areas may or may not turn brown after thawing. Completely frozen, killed leaves appear bleached brown in color. New succulent growth, when frozen, will often turn blackish in color instead of brown upon thawing. Leaf fall within a few days indicates that the wood is not killed while leaf retention on the twigs usually indicates wood kill. Wood damage may be checked by scraping the outer layer of bark. Apparently green tissue in most but not all cases indicates live wood, and brown tissue, dead wood. Totally frozen trees will be covered with curled and brown leaves within 2 to 3 days of the freeze. Ice may also occur in wood and result in bark splits, particularly in young trees. Such splits may be extensive in larger trees resulting in serious trunk injury. Trees may also develop freeze cankers--local areas of bark killed on the limbs and trunks. Scraping the bark away will reveal dead phloem areas. Such cankers will frequently appear in the crotch areas and on exposed limb areas particularly following advection freezes. In future years such limbs may die or break off.

dark water-soaked areas.

Leaf fall.

freeze cankers.

New growth developing on freeze-damaged trees following freezes will often collapse as the wood behind the growth dies. Hence the recommendation not to initiate pruning operations until the extent of the damage is determined. Varieties such as Pineapple oranges and Murcotts, when heavily laden with fruit, will sustain severe freeze damage. Conversely, Murcott trees when lightly cropped will tolerate freezes well.

CREASING

Creasing is a condition sometimes observed on mature oranges, Temples and tangerines. It appears to be most prevalent on thin-skinned fruit, but also may be expressed on Pineapple oranges. Creasing is characterized by narrow sunken furrows on the rind surface running in a predominately horizontal direction giving the fruit a somewhat bumpy appearance. When peeled, the underlying albedo may be observed to be cracked and pulled apart.

Creasing is more likely to express itself under high nitrogen, low potassium conditions. With a balanced nutritional program the condition is less likely to occur. Potassium nitrate sprays have been observed to reduce the incidence of creasing. Creasing does not occur consistently and is considered to be related to climate. The breakdown of the albedo leading to creasing probably begins in late

Creasing.

spring while the fruit is still small. Creasing lowers the fresh fruit pack-out and the fruit may not be desirable for processing as the peel disintegrates easily.

DEAD WOOD AND TWIG DIEBACK

There exists a functional balance between the above and below ground portions of the tree. This is referred to as the shoot:root ratio. It represents the balance between the amount of shoot the root system can adequately supply with water and mineral nutrients, and the amount of roots the shoot can support with organic compounds derived from the photosynthetic process.

As citrus trees mature the scaffold framework and foliage area become greater and the shoot:root ratio increases. As foliage is shaded out, defoliation can occur and branches and twigs may die. The development of a certain amount of such dead wood is natural in the normal development of a citrus tree, and represents the tree's ability to maintain the appropriate shoot:root ratio. Excessive dead wood, particularly in the tree interior and base of the canopy, may indicate a need for pruning to allow the penetration of more sunlight to these parts of the canopy. Routine hedging and topping programs will help prevent the development of leaf and twig dieback in interior canopy locations.Excessive twig dieback on the outside of canopies may result from a number of factors which cause defoliation including freezes, drought, nematodes, decline diseases such as blight, root loss due to water damage, copper toxicity, greasy spot defoliation and spray burn, among others. Tillage operations such as discing during drought stress periods will sever surface feeder roots, and will sometimes lead to leaf wilt and twig dieback.

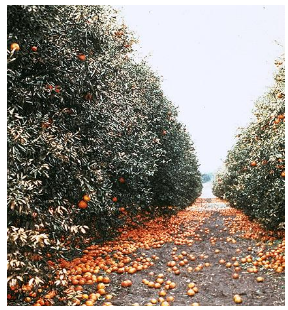
Excessive twig dieback.

A more complex situation may arise when partially inactive root systems in cool soil cannot meet the sudden demand for water by the tree canopy. The resulting water stress can occur in spite of ample soil moisture. Leaves and twigs may desiccate and die immediately on the tree, or they may die sometime later when a heat stress period arrives. Leaf wilt and twig dieback can be promoted by the removal of fruit. This is because leaves can actually compete with fruit peel tissue for water with the latter supplying water to the leaves, thereby alleviating moisture stress.

FREEZE INJURY

Fruit severely injured during a freeze may drop but usually its external appearance is not significantly changed. Temples and grapefruit are particularly susceptible to drop, while oranges are often retained on the tree for longer periods. Certain cultivars such as Murcotts and grapefruit may show dark or reddish-brown depressions, pockets, or pitting on the peel surface. Blemishes in the form of pitting may occur on the peel of grapefruit as a result of nonfreezing temperatures, known as "chilling" injury. Following severe freezes, fruit usually show extensive internal injury which progresses with time. Thin-skinned fruit usually show greater internal injury than thick-skinned cultivars such as grapefruit. The first evidence of freeze injury is the presence of watersoaked areas on the segment membranes with the juice sacs or vesicles in injured areas subsequently becoming dry and collapsed. During the freeze and shortly after, cutting the fruit progressively from the outside to the inside starting at the stem end will show the amount of ice formed and its location. The deeper the ice the greater the severity of injury. This area will eventually dry out leaving the injured fruit partially hollow and lighter in weight than sound fruit of comparable size. Juice loss occurs over a period of several weeks with the extent of loss being dependent on damage severity. The formation of white crystals of hesperidin on the membranes of the fruit is also a symptom of freeze injury but in no way detracts from its eating quality.

Fruit.



Temples.

pitting.

hesperidin.

FRUIT DROP

The annual amount of preharvest (maturity through harvest) fruit loss is perhaps not fully appreciated, but the estimated amount is 10 to 20 percent. There are substantial varietal differences. There is also annual variation, probably related in large part to climate and crop load. Causal factors associated with fruit drop may be categorized into groups. In some cases, a combination of factors, rather than a single factor, may cause fruit drop, making an absolute diagnosis and remedy difficult. Whenever fruit is injured on the tree, the production of ethylene gas is triggered.

If ethylene production persists long enough abscission zone formation is initiated with eventual fruit drop.

Hamlin Fruit Drop

Hamlin fruit drops excessively prior to harvest in some years. Such fruit loss seems to be more serious in heavy crop years and when prolonged warm fall weather conditions prevail. In some cases, drop is more associated with the lower and more shaded areas of tree canopies, particularly where they grow together in tree rows. Although all the causal factors have not been identified, the sequence seems to involve twig defoliation and dieback and eventual fruit drop. Trees should be kept well pruned so that adequate sunlight reaches lower canopy areas. Minimize moisture stress and cultivation operations which can result in severe surface feeder root pruning, especially in shallow flatwoods soil types. Low potassium levels in heavy crop load years can be a contributing factor. Avoid the use of so called "hot" spray mixes under high summer heat conditions (90 degrees F+). Certain pesticides such as Ethion, when mixed with oil and concentrated, have been implicated in leaf drop and twig dieback. This effect may be exaggerated when sprayer nozzles are in close contact with tree canopies (because of lack of hedging) and streams of spray material rather than fully expanded spray patterns impinge on foliage. While most recommended pesticides and nutritional sprays are safe, their application with oil in concentrated form under intense heat stress conditions can result in phytotoxic effects.

Navel Fruit Drop

Navel oranges constitute a group of sweet orange cultivars characterized by a small, secondary fruit at the styler end of the primary fruit. Inadequate fruit set and extensive fruit drop are major causes of low yields of navel oranges in Florida. Fruit drop after fruit set has been found to be related to the unique structure of the styler end. In addition to the postbloom period, there are two distinct periods of fruit drop, summer (mid June - mid August) and summer-fall (late August - late October). The summer drop can reduce fruit numbers by as much as 15 to 20 percent in some years, and the summer-fall drop by an additional 15 percent.

Postbloom drop reportedly occurs mainly in fruitlets with distorted styles and ovaries that fail to develop beyond the embryo stage. The June drop seems to result from competition between fruitlets and young leaves for photosynthetic products, a phenomenon significantly affected by environmental stresses. The third drop period usually involves mature fruit drop prior to harvest.

Secondary fruit yellowing, an important occurrence in many summer drops, results after physical separation of the secondary from the primary fruit through formation of an abscission zone. Fruit with large styler end apertures are more often affected by styler-end decay and fruit splitting. Also, rindlike tissue profusions originating from secondary fruit occur in decayed locales of most primary fruit affected by styler end decay.

HAIL INJURY

Hail injury can be quite severe in localized areas in Florida. The amount and nature of the damage will depend on the severity of the storm and the maturity of the fruit. Injured leaves are torn and shredded and the bark of twigs may be bruised and split. Fruit may be severely pitted with the depressions becoming cracked and corky with time. Scars are usually less obvious if the fruit are young at the time of injury with some recovery occurring with time. Mature fruit may be invaded by decay organisms and deteriorate before healing occurs.

On harvested fruit the damage may be confused with other types of mechanical injury, but on the tree the diagnosis of hail injury can be confirmed by the presence of the torn leaves and the presence of injury mainly on the fruit surface area exposed at the time of the hail storm.

leaves.

Fruit.

HEAT INJURY

Under hot climatic conditions as are encountered in certain citrus growing areas including Florida, temperatures of fruit tissues may be as much as 12 degrees F higher than that of the surrounding air. The difference between the fruit tissue and air temperatures can be greater in the albedo than in the juice vesicles. Externally, the injured portion of the fruit appears as a yellowing of the rind in contrast to the normal green color of a fruit at a relatively early stage of development. Dissection of the injured fruit reveals necrotic and collapsed tissue below the yellow peel area, symptoms of injury from excessive solar radiation.

Most citrus cultivars will exhibit symptoms of sunburn under the right environmental conditions with Murcott fruit being particularly affected due to their upright exposed position in the tree canopy.

Sulfur dust when applied to fruit under very hot conditions will enhance the possibility of fruit burn as it has been known to lower the critical temperature at which fruit is injured by sunlight absorption. The principal factors influencing this temperature relationship in the external environment are intensity of solar radiation, air temperature, and vapor density of air.

LEAF FIRING

The sudden appearance of dead leaves adhering to the tree is commonly referred to in Florida as "firing." It may be regarded as an extreme case of mesophyll collapse. The injury appears to be associated with conditions under which foliage loses moisture more rapidly than it can be replenished. Such conditions may arise following injury from red mites, Texas mites and possibly rust mites. The injury usually occurs following periods of drought and cold dry winds. The stress resulting from root damage under poor drainage conditions and nutrient imbalance may also be involved. Affected leaves wilt suddenly and desiccate while adhering to the tree, with usually one side of the tree or individual twigs being more severely affected. Loss of foliage and eventual twig dieback accompanies this condition, which can be severe.

firing.

Precautionary measures include the maintenance of proper soil moisture conditions, good tree nutrition and mite control. However, under normal stress conditions the injury will probably still occur in localized areas on individual trees.

LIGHTNING INJURY

Citrus trees are occasionally struck by lightning during thunderstorms which are characteristic of Florida summer weather. Damage may range from slight twig injury to sudden death of trees, and from single trees to many.

One or more branches may be killed and strips of dead bark may occur extending down limbs and trunk to the ground. If the soil surface is wet when the tree is struck, the injury can spread at the ground surface and girdle the tree completely. In this case, the bark may be killed to the wood and slough off causing the tree to wilt and die quite abruptly.

slough off.

Symptoms of lightning injury may also be diagnosed by the appearance of green blotches in the leaf node attachment areas of twigs which are otherwise grey/brown in appearance. The early contrast between injured bark and the green leaves, thorns and node areas is quite striking. Injured bark may be greenish/brown in appearance, later turning yellowish-brown, and then be invaded by secondary organism invaders. Frequently the trees adjacent to those killed or severely damaged show scarred twigs and/or dead branches and may continue to deteriorate in condition over time.

Lightning damage may be confused with a girdling of the trunk at and below the soil surface, caused by injury from chemicals such as 2,4-D applied to the soil at weed control concentrations.

MESOPHYLL COLLAPSE

Mesophyll collapse is a breakdown of leaf tissue that can occur when water is lost from the leaf faster than it can be replaced. Leaf symptoms include chlorotic, yellowish, and translucent areas. The areas affected are irregular in size and shape but are often bounded by the midrib and main lateral veins. When held to the light, the affected areas appear translucent, mesophyll collapse from other leaf injuries. Frequently, brown necrotic spots developing in the translucent area will turn black and fall out following invasion by secondary pathogens.

Moderate water stress resulting from warm, windy, and dry weather can promote mesophyll collapse. Other factors that cause or aggravate collapse include inadequate soil moisture, saline water or soil, or root systems injured by drought or flooding. Wind can also cause burn, a more generalized browning and wilting of the leaves.

Mesophyll collapse.

Collapse occurs more commonly in places other than Florida. It is found in the coastal areas of California and other citrus-growing countries. Trees grown under adequate soil moisture conditions and then subjected to occasional severe water deficits are more likely to show mesophyll collapse. Trees grown in arid environments or those continually subjected to water deficits are usually less affected. This is because leaves on trees in wetter areas are less hardened, while trees under continued stress have less total leaf area and are usually more hardened to drought.

Particularly under dry windy conditions, water can be lost by leaves faster than it can be taken up. Although sound irrigation practices cannot always prevent mesophyll collapse, good soil moisture should partly alleviate the situation. Extensive spider mite feeding on leaves, particularly during extended dry periods in the fall, will cause mesophyll collapse which can eventually result in defoliation. Lower surface leaf feeding by rust mites also increases the incidence of mesophyll collapse.

PEEL PITTING

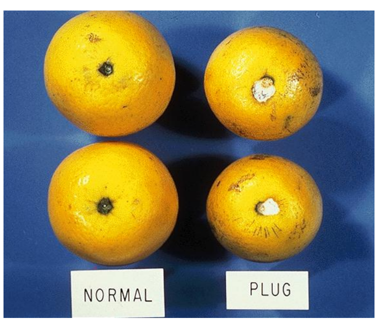
Occasionally, citrus fruit develop brown necrotic spots prior to harvest or shortly after picking. The Pineapple orange is most susceptible to this disorder.Pineapple orange pitting develops on the tree just after color break and is particularly prevalent in the Indian River area. Most of the cell collapse is in the flavedo area and occurs from the equator to the styler end of the fruit. Affected areas are first noticeable on the fruit as sunken areas that subsequently turn a dark brown. On earlier harvested fruit, additional injury areas often become evident after packing and shipping the fruit. All the predisposed areas will develop before harvesting if the fruit is harvested late.

Pineapple orange.

It appears that reduction of water stress is important in reducing the incidence and severity of Pineapple pitting. Fungicides and antitranspirants have reduced their incidence. More surface wax is observed where fungicides are applied to fruit, compared to untreated fruit. Surface microorganisms may be involved in this disorder through their action on the epidermal cells or the surface wax layer. Antitranspirants reduce whole tree and fruit water loss. Long dry spells with poor irrigation practices are often associated with development of fruit pitting in other cultivars.

PLUGGING

Plugging is a condition that can occur in all citrus varieties but particularly among the so-called zipper-skinned mandarin-types and Pineapple orange. Its occurrence is usually associated with rough hand harvesting procedures where the fruit is pulled from the stem rather than snapped. The result is removal of the peel in the stem end area of the fruit.

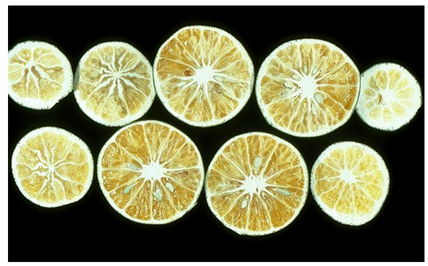


Plugging.

Plugging has been associated with high nitrogen, low potassium conditions, and as in the case of creasing, its incidence will be less under a balanced nutrition program. Plugged fruit will result in reduced pack-out and an increased incidence of postharvest decay.

PREMATURE DRYING

Mandarins and mandarin hybrids, Valencias and grapefruit often exhibit drying of juice vesicles when harvest is delayed beyond normal maturity dates. Seed germination within the fruit may accompany internal drying, particularly in grapefruit. Certain rootstocks, particularly rough lemon, can accentuate the problem with hybrids such as Robinson and Lee tangerines. Premature fruit drying is sometimes a problem associated with young trees, a condition which is alleviated with tree maturity. Drying also appears to be associated with extended warm fall weather.



mandarin hybrids.

SPLITTING

Splitting causes substantial losses of fruit each year and is more severe on some cultivars such as Valencia, Hamlin, and Navel oranges, and Murcotts. Grapefruit, Dancy tangerines, tangelos, and Temple fruit have a lower incidence of splitting.

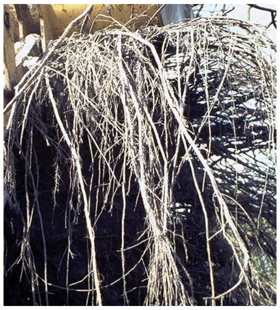
The disorder is characterized by a vertical split beginning at the styler or blossom end and opening longitudinally toward the stem end. Neither the actual nature of the disorder nor all contributing factors are known. Splitting occurs primarily during periods of high humidity or rainfall beginning in August or September and continuing through the fall. Trees from certain budwood selections bearing fruit which split more severely should be avoided. While potassium deficiency resulting in small, thin-skinned fruit promotes fruit splitting, extra potassium will not always correct normal splitting in susceptible cultivars. Control measures suggested include careful budwood selection and good balanced cultural programs, particularly regarding irrigation. Another type of splitting, characterized by irregular cracks which are frequently at right angles to the fruit axis, is symptomatic of severe copper deficiency, but is rarely seen in Florida today.

vertical split.

WATER DAMAGE

Tree and Foliage Response

Chronic water damage can be a major cause of tree decline in some areas of Florida where the water table is close enough to the soil surface to seriously restrict root systems. Such damage is especially prevalent in the low lying areas of the southwest flatwoods and east coast, particularly where there is a hardpan or some other impermeable layer within a few feet of the soil surface. Acute water damage usually occurs following periods of excessive rainfall, with the extent of the root injury being more or less proportional to the extent of water logging and the period over which the high soil moisture conditions prevail. Root death is often associated with toxic metabolic by-products such as sulfides. A characteristic sour or rotten egg (sulfide) soil odor may be associated with such conditions.



root injury.

Trees subjected to chronic water damage are stunted with sparse canopies, dull colored, small leaves and produce low yields of small fruit. New flushes of growth will have small, pale leaves due to poor nitrogen uptake by restricted root systems. Entire groves may be affected, but usually smaller more defined areas will exhibit the symptoms. Striking differences in tree condition can appear within short distances associated with only slight changes in available rooting depths. Water damage may also be recognized by a marked absence of feeder roots and root bark which is soft and easily sloughed.

With acute water damage, foliage wilts suddenly with defoliation following. Trees may totally defoliate and actually die, but more frequently partial defoliation is followed by some recovery. However, such trees remain in a state of decline and are very susceptible to drought when the dry season arrives because of the shallow, restricted root systems. Trees on heavier fine-textured soils can usually tolerate longer periods of flooding than those on sandy soil types.

Identifying Water Damage

Water damage may usually be distinguished from other types of decline by a study of the history of soil moisture conditions in the affected areas. Areas showing such water damage are usually localized and do not increase in size progressively as do areas of spreading decline (burrowing nematode). Virus diseases, blight and footrot can be recognized by visual symptoms, the more scattered distribution of affected trees and by specific diagnostic tests.

Prevention and Recovery

To improve drainage in existing groves is both difficult and costly, so drainage problems should be eliminated when the grove area is prepared for planting by including a system of ditches, beds and/or tiling. Growers should not depend on the slight and often unpredictable differences in rootstock susceptibility to water logging to enable trees to perform satisfactorily under such conditions. Trees, irrespective of scion and rootstock cultivars, should be planted under the best drainage conditions possible. Drainage ditches should be kept free of obstruction through a good maintenance program including chemical weed control. Tree recovery from temporary flooding is more likely to occur under good drainage structure maintenance conditions.

WIND SCAR

Wind is recognized as a problem in citrus production in many areas of the world (Australia, South Africa, California, Florida). Both tree and fruit damage can occur. Florida packinghouses commonly eliminate 15 to 30% of the fruit because of wind scar. Citrus fruit are readily damaged by the midrib or edges of older leaves rubbing on the tender young fruit 0 to 8 weeks after petal fall. Less severe damage can occur from 9 to 12 weeks after petal fall with little damage occurring after that. The damaged areas darken with subsequent wound formation that expands as the fruit grows. With early scarring (0 to 8 weeks postbloom), damaged tissue is completely sloughed off leaving a smooth silvery or brownish blemish. Later damage leads to a rougher surface. Thorn punctures on fruit can occur as another expression of wind induced injury. Winds of 15 to 20 mph (24 to 32 kph) are probably a threshold for causing some fruit damage. Average wind velocity in Florida is highest during the spring when young fruit are most susceptible to wind damage. Annual variation in amount of wind scar can be explained by the total hours of high spring winds from bloom through May, with most of the damaging spring winds being from a westerly or easterly direction. Windbreaks can be beneficial for citrus plantings. For windbreaks to give successful citrus fruit protection the spring winds should have a primary direction and windbreaks should be placed perpendicular to this primary wind direction. Citrus tree hedgerows provide some wind protection when they run perpendicular to primary wind direction.

wind scar.

In years of high spring winds, exposed sites may have such severe wind scar that it is uneconomical to pack fresh fruit. Groves should be monitored for high wind scar development to identify marginal fresh fruit sites. After 12 weeks, samples from top to bottom of exposed tree areas can be evaluated for wind scar. Groves with 20 to 30% wind scar at this time should not receive a fresh fruit spray program as they are probably more suitable for processing.