Post harvest diseases of fruits and vegetables

IMPORTANCE

- May occur at any time during postharvest handling, from harvest to consumption
- Reductions in fruit quantity and quality
- May reduce product value
- Pose a potential health risk – ex. mycotoxins

POSTHARVEST DISEASES

- Caused by fungi and bacteria
- Viruses are not an important cause of postharvest disease

Types

1) **Preharvest infection – quiescent / dormant infections**
   - Pathogen initiates infection before harvest, but then enters a period of inactivity or dormancy until the physiological status of the host tissue changes in such a way that infection can proceed.
   - Ex. anthracnose of various tropical fruit (*Colletotrichum spp.*) and grey mold of strawberry (*Botrytis cinerea)*

2) **Postharvest infection – mechanical wounding**
   - Arise from infections initiated during and after harvest.
   - Blue and green mould (*Penicillium spp.*) banana crown rot (*Fusarium spp*)

MMON STHARVEST EASES AND THOGENS OF UIT CROPS.

S. No.	Fruit crops	Disease	Pathogen
1	**Temperate fruits**	Blue mould	*Penicillium spp.*
2	Pome fruit	Gray mould	*Botrytis cinerea*
3		Bitter rot	*Colletotrichum gloeosporioides*
4		Alternaria rot	*Alternaria spp.*
5	Stone fruit	Brown rot	*Monilia spp.*
6		Grey mould	*Botrytis cinerea*
7		Blue mould	*Penicillium spp.*
8		Alternaria rot	*Alternaria alternata*
9	Grapes	Grey mould	*Botrytis cinerea*
10		Blue mould	*Penicillium spp.*
11	Berries	Grey mould	*Botrytis cinerea*
12		Cladosporium rot	*Cladosporium spp.*
13		Blue mould	*Penicillium spp.*
14	**Subtropical fruit**	Blue mould	*Penicillium italicum*
15	Citrus fruit	Green mould	*Penicillium digitatum*
16		Black centre rot	*Alternaria citri*
17		Stem end rot	*Phomopsis citri*
18	Avocado	Anthracnose	*Colletotrichum gloeosporioides,*
19		Anthracnose	*Colletotrichum acutatum*
20		Stem end rot	*Dothiorella spp.*
21		Bacterial soft rot	*Erwinia carotovora*
22	**Tropical fruit**	Anthracnose	*Colletotrichum musae*
23	Banana	Crown rot	*Fusarium spp.*
24		Black end	*Nigrospora spharica*
25		Ceratocystis fruit rot	*Thielaviopsis paradoxa*
26	Mango	Anthracnose	*Colletotrichum gloeosporioides*
27		Stem end rot	*Phomopsis mangifera*
28		Black mould	*Aspergillus niger*
29		Alternaria rot	*Alternaria alternate*
30		Grey mould	*Botrytis cinerea*
31		Blue mould	*Penicillium expansum*
32	Pawpaw (Papaya)	Anthracnose	*Colletotrichum spp.*
33		Black rot	*Phoma caricae papaya*

1. *Alternaria spp*

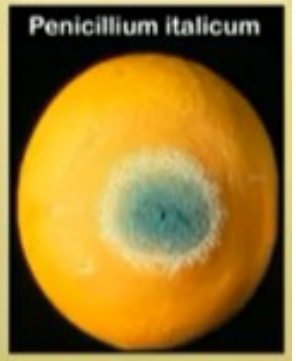
- Preharvest and postharvest fungal disease. E.g., black rot of orange, tuber rot of potato, rot of sweet potato, Alternaria rot of apple, onion, cabbage, capsicum etc.
- **Symptoms:**
- Round, brown to black lesions, often centred around a skin break or weakened tissue. The spots are firm, dry and shallow.
- In advanced stages, rotted tissues become spongy and the affected flesh turns black.
- **Management:**
- Practice orchard sanitation and "soft handling" of fruit.
- Harvest fruit at proper maturity.
- Careful handling during picking, washing, and packing
- Hot water treatments (57C, 30 sec.)
- Prochloraz + benomyl combination, imazalil fungicides
- One minute dip in a chlorinated solution of (0.5 g/l)
- Store fruits at proper temperatures. Ex 0° to 4 °C for apples

2. *Botrytis cinerea* (Grey mold)

- Fungal disease of Pear, apple, citrus, grapes etc., and vegetables like onion, tomato etc. Quiescent in strawberry
- **Symptom**:
- Decayed area with a light brown to dark brown appearance.
- Water-soaked spots that rapidly expand into large yellowish-green or grayish-brown, irregular lesions that are soft and spongy in texture
- Velvet-like fungus mycelium and grey spores are produced on the lesion surface under cool, humid conditions
- Diseased tissue does not separate from the healthy tissue
- **Management**:
- Preharvest disease management and by postharvest practices.
- Use of chemical fungicides, biocontrol agents, physical means, natural antimicrobials, and decontaminating agents.
- Grey mould can be controlled by prompt cooling.
- One minute dip in a chlorinated solution of (0.5 g/l)
- Sodium bisulphate (grape guard) which releases SO2 when in contact with moist air can be used with packing material.
- 250- 500 mg/l Benomyl, 500-2000 mg/l thiabendazole or 1000 mg/l carbendazim

3. *Penicillium spp* (Blue & green molds)

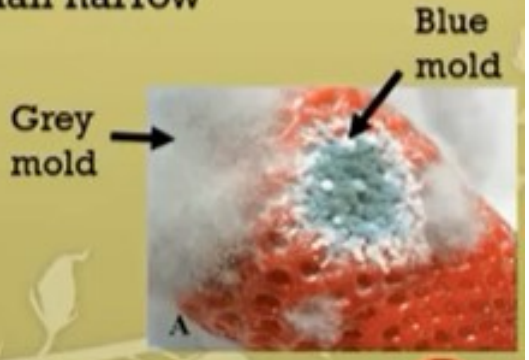
Green mold (*P digitatum*)	Blue mold (*P italicum*)
Room temperature	< 10 C
Spores in soil	Spores in storage room, air, walls, floors, bins
Infect through wounds	Infect healthy fruits
Doesn't spread by nesting	Spread by nesting
Citrus, pistachios, black olives	Citrus, Pome fruits, mango, grapes, berries



- Produce ethylene which increases respiration of fruits
- Patulin — a mycotoxin.

Symptoms

- Watery spots with white mycelium produced at the centre.
- Massive sporulation zone of green or blue color, surrounded by a small narrow band of white mycelium.



Management

- Minimize fruit injury
- Orchard and packinghouse sanitation.
- 250- 500 mg/l Benomyl , 500-2000 mg/l thiabendazole or 1000 mg/l carbendazim
- Hot water dip

3. *Penicillium spp* (Blue & green molds)

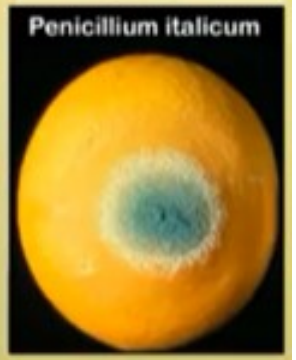
Gree
Room
Spore
Infect
Does
Citru
- Pro
- Pat

Sym
- Wa
- Ma bar

Man
- Mir
- Orc
- 250 car
- Hot

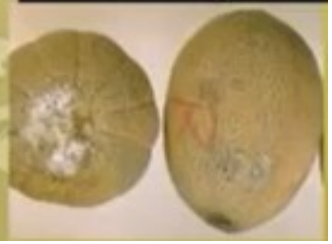
Cousins, in 1910, showed oranges shipped with bananas caused the bananas to ripen prematurely. Later work showed it was the few damaged and moldy oranges that produced the ethylene.

http://blog.gardaen.com/wp-content/uploads/2007/12/moldy_mandarin_orange.jpg



4. *Fusarium spp* (Pink or Yellow Mold)

- Brown rot of fruits like lemon, orange, Dry rot of Potato, Fusarium basal rot onion, garlic, and other *Allium* spp, Crown rot of banana
- **Symptoms**
- **Dry rot potato** - internally, infected areas are light brown to black as the fungus kills the cells of the tuber
- **Basal rot** - Infected bulbs are softened, brown and watery when cut open
- **Crown rot** begins with a mycelium development on the crown surface, followed by an internal development
- Fruit rot causes lesions covered by white mycelia and conidias and fruit drop



- **Management**
- Use resistant cultivars where available
- Preventive field sprays
- Hot water treatments (57°C, 30 sec.)
- Benomyl, Imazalil are very active against Fusarium

5. *Colletotrichum gloeosporioides*

- Anthracnose - mango, papaya, chilli, and avocado. Bitter rot – Pome fruits
- Damaging phase -quiescent infection -preclimacteric phase
- Growth resumed after harvest during ripen and significant decay losses during storage and marketing.

- **Symptoms**
- Mango - small, black, circular spot appears on the fruit skin
- Chilli - Small, circular spots, fruit drop
- Tomato - Watersoaked circular sunken lesions
- Apple - small, circular, brown lesions that enlarge

- **Management**
- One minute dip in a chlorinated solution of (0.5 g/l)
- Hot water immersion (HW) and calcium chloride (Ca) treatments
- Dip in prochloraz at 250 ppm for 30 s

INTEGRATED APPROACH FOR MANAGEMENT OF POST- HARVEST DISEASES

I. Pre-harvest Care

- A. Phytosanitation
- B. Pre-harvest Chemical Treatments
- C. Resistant Cultivars

II. At Harvest Care

- A. Maturity at Harvesting
- B. Harvesting Technique

III. Post-harvest Care

- A. Handling and Packaging
- B. Care during Transport
- C. Storage

PRE-HARVEST CARE

a) **Phytosanitation**

1. Simple and effective measure to keep the incidence of diseases low.
2. Fallen fruits, infected leaves and dead twigs can harbor a large quantities of inoculums.
3. Packing house sanitation

b) **Pre-harvest Chemical Treatments**

1. Application of broad-spectrum protective fungicides.
2. Ex. Carbendazim for Anthracnose of mango, banana and other tropical fruit crops.

c) **Resistant Cultivars**

1. Differences in cultivar characteristics can markedly affect the keeping quality of the fresh produce
2. Ex Keitt mango is resistant to anthracnose

AT HARVEST CARE

a) Maturity at Harvesting

1. Influence the post-harvest losses.
2. Both over mature as well as pre-mature harvesting can make the fruits more prone to post- harvest infection.
3. Harvest the fruits at proper stage by considering the size, shape, colour, flesh firmness, sugar, starch and oil content.
4. Fruit become increasingly susceptible as they approach ripen

b) Harvesting Technique

1. Choosing the most appropriate time and technique of harvesting is most important.
2. Fruits and vegetables require a careful harvesting technique because of their delicate nature
3. Simple manual harvesting methods however, are usually quite effective and satisfactory.

POST HARVEST CARE

A. Handling and Packaging

1. No mechanical injury
2. Sorting and grading
3. Packing suitable to produce

B. Care during Transport

1. Mode of journey
2. Nature of commodity and
3. Distance and duration of the journey

C. Storage

1. Preventing the perpetuation of pathogen and spread of the disease.
2. Low pressure storage
3. Cold storage
4. Modified atmosphere storage

PHYSIOLOGICAL DISORDERS

Low temperature disorders:

- Chilling injury
- Freezing injury

TABLE 8.1 CHILLING INJURY SYMPTOMS OF SOME FRUITS

PRODUCE	LOWEST SAFE STORAGE TEMPERATURE (°C)	SYMPTOMS
Avocado	5–12*	Pitting, browning of pulp and vascular strands
Banana	12	Brown streaking on skin
Cucumber	7	Dark coloured, water-soaked areas
Egg plant	7	Surface scald
Lemon	10	Pitting of flavedo, membrane staining, red blotches
Lime	7	Pitting
Mango	5–12	Dull skin, brown areas
Melon	7–10	Pitting, surface rots
Papaya	7–15	Pitting, water-soaked areas
Pineapple	6–15	Brown or black flesh
Tomato	10–12	Pitting, Alternaria rots

* A range of temperature indicates variability between cultivars in their susceptibility to chilling injury.

Figure 8.3
Time sequence of events leading to chilling injury
SOURCE G.R. Chaplin, personal communication.

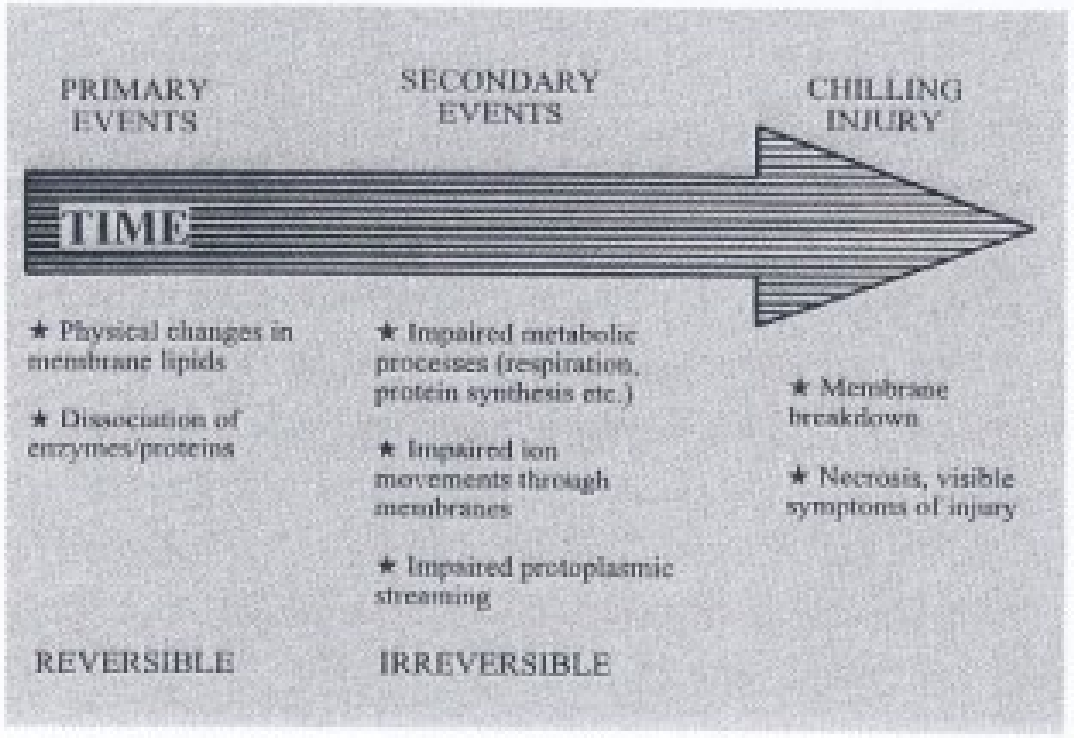


TABLE 8.3 SOME PHYSIOLOGICAL DISORDERS OF FRUITS OTHER THAN APPLES

PRODUCE	DISORDER	SYMPTOMS
Pear	Core breakdown	Brown, mushy core in overstored fruit
	Neck breakdown, vascular breakdown	Brown to black discolouration of vascular tissue connecting stem to core
	Superficial scald	Grey to brown skin speckles; occurs early in storage
	Overstorage scald	Brown areas on skin in overstored fruit
	Brown heart	Same as for apple
Grape	Storage scald	Brown skin discolouration of white grape varieties
Citrus	Storage spot	Brown sunken spots on surfaces
	Cold scald	Superficial grey to brown patches
	Flavocellosis	Bleaching of rind; susceptible to fungal attack
	Stem-end browning	Browning of shrivelled areas around stem-end
Peach	Woolliness	Red to brown, dry areas in flesh
Plum	Cold storage	Brown, gelatinous areas on skin and flesh breakdown

TABLE 8.4 CALCIUM-RELATED DISORDERS OF FRUIT AND VEGETABLES

PRODUCE	DISORDER
Apple	Bitter pit, lenticel blotch, cork spot, lenticel breakdown, cracking, low temperature breakdown, internal breakdown, senescent breakdown, Jonathan spot and water core
Avocado	End spot
Bean	Hypocotyl necrosis
Brussels sprout	Internal browning
Cabbage	Internal tipburn
Chinese cabbage	Internal tipburn
Carrot	Cavity spot, cracking
Celery	Blackheart
Cherry	Cracking
Chicory	Blackheart, tipburn
Escarole	Brownheart, tipburn
Lettuce	Tipburn
Mango	Soft nose
Parsnip	Cavity spot
Pear	Cork spot
Pepper	Blossom-end rot
Potato	Sprout failure, tipburn
Strawberry	Leaf tipburn
Tomato	Blossom-end rot, blackseed, cracking
Watermelon	Blossom-end rot