

**Post harvest
diseases in
Apple, Mango,
Banana
Citrus, Grapes
and Papaya**

Post Harvest diseases of Apple

1. Apple scab : *Venturia inaequalis*
2. Bitter rot : *Glomerella cingulata*
3. Blue mould / Green mould : *Penicillium italicum*
4. Grey mould : *Botrytis cinerea*
5. Alternaria rot : *Alternaria alternata*
6. White rot : *Botryosphaeria dothidea*
7. Brown rot : *Sclerotinia frunctigena*

1. Apple scab: *Venturia inaequalis*

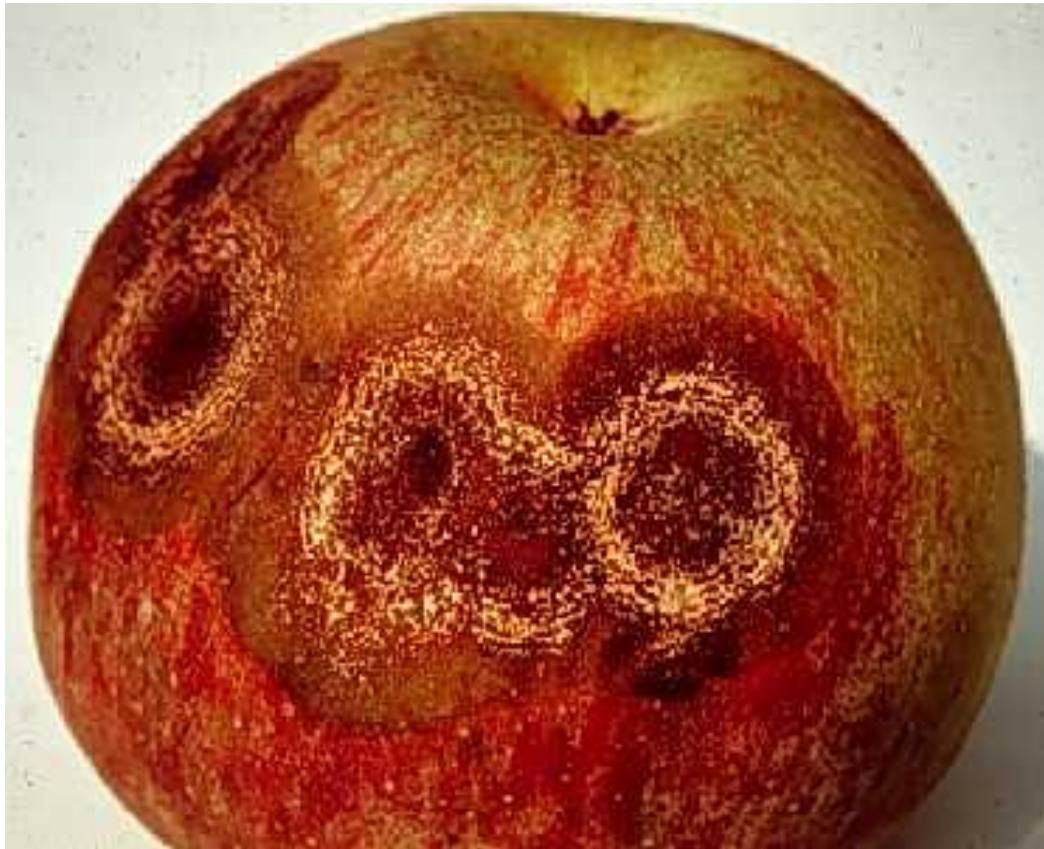
Small, rough, black, circular lesions on their skin and become **sunken**. Affected fruits rot due to **secondary** infection of the lesions.

Pre-harvest sprays of **Mancozeb**. Last spray should be 15-20 days before harvest.



2. Bitter rot: *Glomerella cingulata*

Small, brown, circular spots present. Later become sunken, forming a **saucer-shaped** depression. **Pink fruiting bodies** of the fungus develop in the centre of the rotten area. Rot **penetrates deeply** into the flesh.

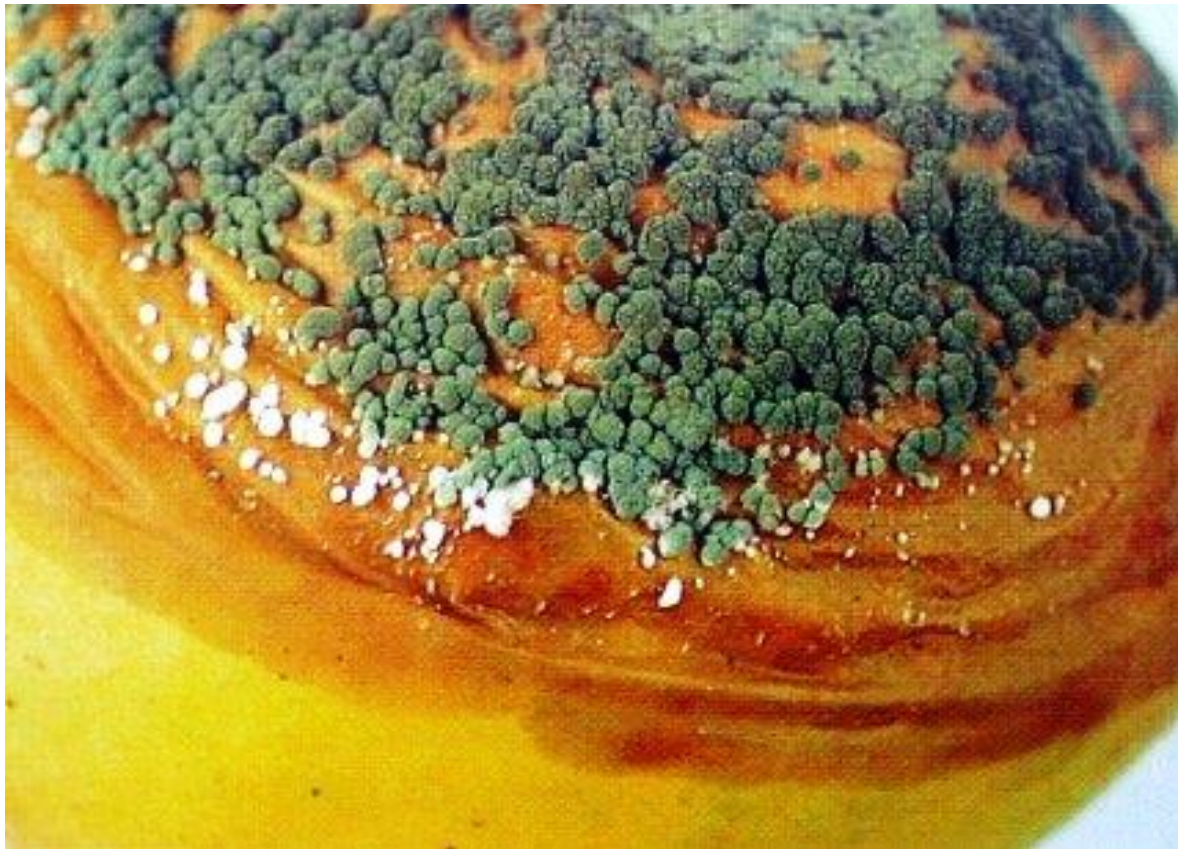


3. Blue mould / Green mould rot: *Penicillium italicum*

Affected fruits become **watery**. Watery spot increases and entire fruit rots. **Emits bad smell**

Green fungal growth is seen on the surface of the fruits.

Pre storage dip in **Thiobendazole (TBZ 500ppm)** for 2-3 minutes.



4. Grey mould: *Botrytis cinerea*

Infected fruits turn **slightly brownish**. The fungus advances into the **inner flesh** resulting in a **soft, watery mass of decayed tissue**. **Sporulation** can be seen as **powdery grey** mass. In advanced stage, a pleasant **sweetish fermented odour** is produced.

Sodium bisulphate which releases SO₂ when in contact with moist air can be used with packing. **Grey mould** can be controlled by **prompt cooling**.



5. Alternaria rot: *Alternaria alternata*

Round, brown to black lesions, often centred around a skin break or weakened tissue. The spots are firm, dry and shallow. In the advanced stages, the rotten tissues become spongy and the affected flesh turns black.

6. White rot: *Botryosphaeria dothidea*

The lesions begin as **small, often circular, slightly sunken** brown to tan spots surrounded by red halo. Rotted area extends in a cylindrical manner towards the core.

Pre-harvest sprays of **Carbendazim** 2-3 times starting six weeks before harvest do provide good control of this rot.



7. Brown rot: *Sclerotinia frunctigena*

Superficial, circular brown spots develops which results in soft decay of the flesh. **Tufts of grey fungus** in **concentric** bands cover the surface of the lesions.

As the disease progress, the skin of apples turn **shiny and black**.

Sprays applied 2-3 weeks before harvest to protect **injured fruits** from brown rot infection.



Post Harvest Diseases of Mango

1. Anthracnose : *Colletotrichum gloeosporioides*
2. Stem end rot : *Botryodiplodia theobromae*,
Diplodia natalensis
3. Black mould rot : *Aspergillus niger*
4. Brown spot : *Pestalotia mangiferae*
5. Black soft rot / *Phomopsis* rot : *Phomopsis mangiferae*
6. Bacterial rot : *Pseudomonas mangiferae-indicae*

1. Anthracnose *Colletotrichum gloeosporioides*

Latent infection of fruits occurs before harvest.

Sunken black spots appear on the surface of the fruit during ripening. These spots then coalesce. The affected areas mostly crack. Under moist conditions, pink spore masses are seen over the lesions.

Effective control by dipping the fruit for 2-3 minutes before storing them in Benomyl (1000 ppm) or TBZ (2000 ppm).





2. Stem End Rot: *Botryodiplodia theobromae*, *Diplodia natalensis*

In fruits, the pericarp darkens near the base of the pedicel. The affected area enlarges to form a circular, black patch which under humid atmosphere extends rapidly and turns the whole fruit completely black within two or three days. The pulp becomes brown and softer. Dipping of fruits in Aureofungin (100 ppm) gives good control.



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3. Black mould rot: *Aspergillus niger*

Yellowing of base, development of irregular, hazy, greyish spots which coalesce into dark brown or black lesions.

Mesocarp of the rotted area becomes depressed and soft. The fruit surface is covered with blackish fungal growth.

Dipping of fruits in fungicides will reduce the disease.



4. Brown spot: *Pestalotia mangiferae*

On matured green fruits, **small brown spots** appear with **greyish white centre** which later turn to bigger lesions with large number of **acervuli seen** as black dots. The affected area of fruits becomes **olivaceous black** and shrinks. Black dots appear at the **centre of the spots representing the acervuli.**

5. Black soft rot / *Phomopsis* rot:

Phomopsis mangiferae

Discrete and discoloured areas all over which turn dark brown to black at maturity. Black fruiting bodies appear on the spots.

6. Bacterial rot: *Pseudomonas mangiferae-indicae*

Water-soaked lesions develop which turn into dark brown to black. The spots become black as the disease advances, which are usually halos. Cracks may develop in the skin.

Agrimycin 100 as fruit dip treatment was found to be the best.

Post harvest diseases of Banana

1. Anthracnose : *Colletotrichum musae*
2. Fluffy white rot : *Fusarium moniliforme*
3. Crown rot / Black tip : *Botryodiplodia theobromae*
4. Cigar-end rot : *Verticillium theobromae*.

1. Anthracnose: *Colletotrichum musae*

Small, black, circular specks on the skin become **sunken** and **coalesce** to form large spots.

Conidial mass appears on the spots.

Immersion of green fruits in **hot water at 55°C for 2 min**, **control the disease**.

Post harvest **dipping of fruits in Carbendazim 400 ppm**, or **Benomyl 1000 ppm**, or **Aureofungin sol 100 ppm**.



2. Fluffy white rot : *Fusarium moniliforme*

Olive brown spots are seen in the middle or in the tip portion. The fruit turns brown, become pulpy, liquid oozes and emit an undesirable odour. Finally the rotted fruits get covered with white cottony growth of the fungus.

Post harvest dipping of fruits in Carbendazim 400 ppm, or Benomyl 1000 ppm, or Aureofunginsol 100 ppm



3. Crown rot / Black tip : *Botryodiplodia theobromae*

It is a **wound parasite** which attacks more in humid and hot months. The tip of fruits **turn black**, the lower healthy portion is yellow and the **pulp becomes soft** leads to **bad smell**. In the humid weather, **white or light grey cottony mycelium and black pycnidia** will be seen on the affected area.

Dipping of fruits in **Benomyl 200 ppm** controls the rot.



Crown rot

4. Cigar-end rot: *Verticillium theobromae*.

The symptoms start from the tip of the finger and slowly spreads backwards causing greyishness of the skin. Distal end of finger rots which on drying, gives appearance of a lighted cigar.



Post Harvest diseases of Citrus

1. Black rot : *Alternaria citri*
2. Aspergillus rot : *Aspergillus niger*
3. *Penicillium* rot : *Penicillium italicum*, *P. digitatum*

Black Rot : *Alternaria citri*

The infected fruits bear small spots black in colour which may coalesce to cover the entire fruits.



Aspergillus Rot: *Aspergillus niger*

Initially small **circular water soaked spots** appear. The fungal mycelium **appearing white** can be seen on the affected area which **later turns black** due to **sporulation** of the fungus. Ultimately the fruit develops **soft rot** and **give alcoholic smell**.

Injury should be avoided during **harvesting** and **packing** to minimize the rot.

Penicillium Rot: *Penicillium italicum*, *P. digitatum*

(Blue and green mould)

These moulds cause watery rot during transit and storage in which the rind breaks easily on pressing. The affected area gets covered with green or blue moldy growth and the fruit emits a fowl smell. The infection spreads from infected fruits to healthy ones in the packing cases.

The moulds can be controlled by dipping the fruits in Bleaching powder (2%) for 5 min.

Penicillium rot



Post Harvest diseases of Grapes

1. Blue mould rot : *Penicillium spp.*
2. Black mould rot / Stalk end rot : *Aspergillus niger*
3. *Cladosporium* rot : *Cladosporium herbarum*,
C. oxysporum, *C. tenuissimum*
4. Soft rot : *Rhizopus nigricans*
5. Grey mould rot : *Botrytis cinerea*
6. Anthracnose : *Elsinoe ampelina*

Blue mould rot : *Penicillium spp.*

In **transit**, the infection enters **through pedicels**. The tissues of the **decaying berries** become slightly brown and **soft watery**. They develop a **moldy flavour**. The pathogen **growth is white** in the beginning and becomes **bluish green** later.

Careful handling during **picking and packing** followed by **fumigation** with **Sulphur dioxide** (0.5%) for 20 minutes gives effective control.



Black mould rot or Stalk-end rot: *Aspergillus niger*

Affected berries show brownish rot at the stalk end.

Disease tissue shows watery decay and shrunken, white mycelial growth of the fungus develops and later black powdery masses are produced. A fermenting odour is emitted from the rotting fruits. The infected fruits become pulpy and fall off easily.

Fumigation with Sulphur dioxide give effective control.



Cladosporium Rot : *Cladosporium harbarum*,

C. oxysporum* and *C. tenuissimum

This rot causes a **black, firm, shallow decay on one side** or at the blossom end. Infected areas are firm and comparatively dry. The fruit **becomes flat or wrinkled** on the affected side. On the surface, **olive green fungal growth is seen.**

Field spray with various fungicides and **Sulphur dioxide fumigation** in storage gives good control.

Soft Rot : *Rhizopus nigricans*

The pathogen enters through cracks or wound. Fruits become soft and the fruit is covered by profuse mycelial growth.

Proper handling during picking, transport and marketing. Fumigation with Sulphur dioxide during storage and cold storage reduce its incidence.



Grey mould rot / Botrytis rot : *Botrytis cinerea*

Appears as **small, circular, faintly cleared** spots. The affected area may turn **slightly brownish**. The skin slips from the diseased spots. The fungus advances into the **inner flesh** resulting in a soft, watery mass of decayed tissue. The fungus **grows over the berries**. Affected fruits **shriveled** and turn dark brown.

The rot can be checked by preventing **field infections**, **careful** handling, pre-cooling and by post-harvest **fumigation** with **Sulphur dioxide**.





Anthracose: *Elsinoe ampelina*

On the berries, **circular brown sunken spots** with dark brown margins develop which leads to **shrivelling** and **drying**. The flesh of the affected berries remain firm. Sometimes **the fruit cracks** or the **scabby** areas appear on the mature fruit.



Grape Anthracnose

PAPAYA

1. Anthracnose : *Collectotrichum gloeosporioides*
C. papyae, Gloeosporium papayae
Glomerella cingulata
2. Soft Rot : *Rhizopus stolonifer*
3. Dry Rot and Stem-end Rot : *Botryodiplodia*
theobromae *Fusarium solani, Phomopsis*
caricae-papayae
Macrophomina phaseoli
Alternaria alternata
4. Fruit Rot : *Phytophthora parasitica*

1. Anthracnose : *Collectotrichum gloeosporioides*

C. papayae, Gloeosporium papayae ,

Glomerella cingulata

Initial symptoms appear as **small ,round dark** areas. It enlarges rapidly forming circular, **slightly sunken, water soaked** lesions. Fungus produces large **masses of spores** in the central portions of the lesions in **concentric ring**, which is in **light orange or pink**.

Fumigation with **Benzyl isothiocyanate** will control post-harvest rots.



2. Soft Rot : *Rhizopus stolonifer*

Appears as **soft watery rot** with profuse **mycelial growth** especially in storage. The rot rapidly involves the entire fruit and quickly spreads to other fruits. The infected fruits **emit fowl odour**. It invades **primarily injured** mature fruits.

Avoid injury. **Hot water treatment** and **washing of fruit** with water immediately after harvesting minimize the losses. Store houses may be **kept clean**.



3. Dry Rot and Stem-end Rot : *Botryodiplodia theobromae*, *Fusarium solani*, *Phomopsis caricae-papayae*, *Macrophomina phaseoli* and *Alternaria alternata*

Fungi **invade the tissues** and cause fruit **rot**.

Fusarium solani causes dry fruit rot and produces **white mycelium**.

M. phaseoli affected fruits turn black and bear the **fungus sclerotia**.

P. caricae-papayae develops water soaked spots which become **soft and pulpy**.

A. alternata produces grey brown circular to semi-circular patches, **covered with fungal growth**.



B. theobromae causes **stem end rot** and which shows brownish black lesions.

Control of fruit rot by **hot water treatment** or **hot air treatment** gives good control.

Fruit Rot : *Phytophthora parasitica*

The diseased tissues remain firm and **do not show any leakage**.

Avoiding injury to fruits and **hot water dipping** minimizes the rotting



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