

Integrated Disease management in citrus



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Gummosis/leaf fall/ fruit rot

Symptoms

- The disease occurs especially in the high rainfall areas.
- Gumming on the surface of the attacked bark.
- The bark shows conspicuous brown staining along with hardened masses of gum on the surface.
- The fungus produces blight symptoms on leaves.



Chemical control of *Phytophthora* causing root rot, Foot rot and Gommosis:



Gummosis



Pasting of Metalaxyl



Drenching

Two sprays with drenching either by Fosetyl-Al (2.5g/L) or Metalaxyl MZ-72 (2.75g/1 water) covering the whole plant canopy and basin of affected plant at 40 days interval after onset of monsoon.

For the control of gummosis, scraping of the affected parts followed by application of Metalaxyl MZ-72 paste.

Management:

- Resistant rootstocks like sour orange (*Citrus aurantium*), *Poncirus trifoliata* or its hybrids like citranges and Cleopatra mandarin can be used.
- Proper drainage facilities are to be provided. Excess irrigation should be avoided.
- Injuries to plants should be avoided.
- Continuous contact of trunk with water has to be avoided by adopting ring system of irrigation and by heaping earth around the base of plants.
- Double ring basin system around the trunk may be provided. The inner ring being 45 cm away from the trunk. This prevents direct contact of water with the trunk.

- Planting pits may be dusted with a mixture of Zinc Sulphate, Copper Sulphate and quick lime (5:1:4) just before planting.
- The diseased bark along with a little portion of healthy tissue may be removed with a knife and the exposed tissue is painted with Zinc Sulphate – Copper Sulphate – Lime paste (0.6:0.2:0.5 kg in 100 litres of water).
- Healthy tree should be protected by protected by painting with Bordeaux mixture upto a height of about 50 to 75 cm above the ground level in the trunk once in a year.
- Diseased leaves and fruits should be collected and burnt.
- Spraying with Bordeaux mixture 1.0 per cent or with tin Sulphate or Difolatan 0.3 per cent or Metalaxyl- Mancozeb 0.2 per cent and Fosetyl – AL (Aliette) control the disease

Ganoderma Root Rot

Symptoms:

- The affected tissues of the wood die and are discolored.
- The wood becomes soft and decomposed.
- The aerial parts and branches start drying.
- In advanced stages, woody brick-like fructification of the fungus makes its appearance at the base of the trunk.
- Ultimately the whole tree dies up.



Management:

- If few roots are affected they may be cut and removed. In addition the soil is to be mixed with powdered sulphur at the rate of 0.5 to 1 kg per tree.
- The debris should not be allowed to come in contact with the healthy roots.
- Growing and incorporation of green manure in the soil is beneficial in checking the disease.
- The infected trees should be isolated by digging a trench of 30 cm wide and 60 cm to 90 cm deep around the tree at a distance of 2.5 to 3.0 m from the base to prevent the contact of diseased roots with healthy roots.
- Dead or decaying stumps and brackets of fungus should be removed from the orchard and destroyed.
- Tree basin is drenched with Aureofungin-sol 0.03 per cent or Carbendazim 0.05 per cent, a day after irrigation to check the disease.

Diplodia gummosis

Symptoms:

- it affects sweet orange and mandarins.
- Gum oozes from one or two spots near forks or bigger limbs.
- Infection is usually high above the ground. Infection starts at cracks or at crotches of branches.
- Bark is killed; gum oozes out, dries and become black.

Management

- The trees should be kept in a vigorous growing condition.
- Wound in the bark especially on limbs and forks be scraped and protected with Bordeaux paste. Broken limbs should be cut properly



Dry Root Rot

Symptoms:

- The bark of the bigger roots begins to decay below the soil surface.
- The bark is at first moist and darkened. Later the bark becomes shredded and remains dry.
- Large parts of the roots decay. The leaves turn yellow and are shed.
- As a result an unusually large crop of small sized fruits is borne.

Management:

- The affected root should be cut out and the cut end are to be smeared with Bordeaux paste and protected.
- In heavy soils, the condition of the soil can be improved by addition of green manure.
- Proper Manuring especially with nitrogen and irrigation should be given.
- Spraying with urea on the foliage helps in the recovery from the disease.
- Disease is effectively controlled if the tree basin is drenched with Carbendazim 0.1 per cent followed by another drenching of Mancozeb 0.25 per cent or Chlorothalonil 0.2 per cent , 12 to 24 h after irrigation at monthly intervals. One litre of each chemical should be used per sq. m. of the basin.

Anthracnose /wither Tip/ Die –Back.

Symptoms:

- The disease affects branches, the branches begin to wither from the tip downwards.
- The drying back gradually progresses downward with the leaves turning yellow, withering and drooping and gum formation on the stem



Management:

- Dried twigs should be pruned.
- The cut ends should be protected by painting with Bordeaux paste or any other copper fungicide.
- Such trees may be thrice with Carbendazim 0.1 per cent or Captafol 0.2% after pruning.
- The trees should be adequately manured with urea. Urea at 100 g per every 10 litres of spray solution should be mixed for increasing the vigour of the plant.
- Drainage facilities should be improved. Trees should be properly irrigated. Periodical spraying with Bordeaux mixture 1.0 % or Ferbam or Zineb or Captan 0.2 % gives good control. Zinc Sulphate, Copper Sulphate and lime mixture at 0.6: 0.2: 0.5 kg in 100 litres of water is also effective.

Powdery Mildew

Powdery mildew is common during winter months and is seen in almost all the varieties. It is serious on mandarin and sweet oranges.



Symptoms:

- On the upper surface of the leaves white powdery patches of fungal growth are seen.
- The patches extend and cover the whole leaves.
- Petiole and stems are also covered by whitish fungal growth.
- The affected leaves show yellowing and crinkling and they drop prematurely. In severe infections young fruits show mildew growth and drop off.

Management:

- The affected plant parts should be removed and destroyed carefully.
- Water shoots should be pruned to reduce infection.
- Dusting finely powdered Sulphur gives effective control.
- Prophylactic spray with Wettable Sulphur 0.2 % or Tridemorph 0.1% or Carbendazim 0.1 % control the disease. Spraying with Carbendazim 0.05 % at 20 days interval is also recommended

Scab / Verucosis

Symptoms:

- The disease attack leaves, twigs and fruits. the affected leaves often become distorted, wrinkled, stunted and mis-shaped; the opposite surface corresponding to the warty growth shows a circular depression with a pink to red centre.
- The twig infection also results in similar lesions and the affected twigs are ultimately killed.
- On the fruits, scabby or corky lesions develop and they soon coalesce affecting larger areas on the fruits
- The surface becomes rough and distorted. The fruits may be dropped. In some places 25 to 55 % of the fruits susceptible varieties were completely spoiled owing to severity of scab.



Management:

- The diseased leaves, twigs and fruits should be collected and destroyed.
- Spraying with Bordeaux mixture 1.0 % is quite effective. Spraying with oxychloride 0.3 % or difolatan 0.2 % or chlorothalonil 0.2 % at 15 days interval is effective in controlling the disease.

Pink Disease

Symptoms:

Usually the disease appears during or just after monsoon.

- It is characterized by the presence of whitish or pinkish fungal growth on the twigs and limbs.
- In early stage of the disease slight gumming of the bark may be seen. Leaves turn yellow and dry. The affected portions show silvery – white film of mycelium studded with small pink pustules.
- In advanced stages, the bark dries up developing longitudinal cracks. The wood becomes brown and limbs finally wilt as the tissues are destroyed.

Management:

- Affected twigs and branches should be pruned including a few cm of healthy portion and burnt.
- It should be followed by application of Bordeaux paste at cut ends. Spraying with Bordeaux mixture 1.0 % or Lime Sulphur protects the plants from further attack by fungus.

Canker and Bark Eruption

Symptoms:

The disease attacks seedlings and grown up trees.

i. Seedlings:

In young plants, especially in the nursery, the canker spots often girdle the stems to cause partial or complete death of the plants.

ii. On fruits:

The infection spreads to the fruits on which typical crater –like cankerous spots are formed.

Yellow halo around the canker is absent in fruits. The cankers may be scattered all over the surface or several cankers may occur together forming an irregular scurfy mass



iii. Trees – on leaves;

On the leaves the disease first appears as small, watery, translucent spots of yellow color, than the surrounding tissue and with raised convex surfaces.

The spots may appear on either side of the leaf but are usually on the lower surface.

As the spots mature, the surface becomes white or grayish and finally ruptures in the centre giving a rough, hard, and corky and crater- like appearance.

The lesions which are circular when young become irregular when old.

The old lesions are light brown in grape fruit ,dark brown in sweet orange , mandarin orange and trifoliate orange and almost black on lime and lemon leaves.

Management:

- Dropped off canker affected leaves and twigs should be collected and burnt
- Disease free nursery stocks should be used for planting in new orchards.
- The plants before planting in new orchards should be sprayed with Bordeaux mixture 1.0 %.
- In old orchards pruning of affected plants parts before the onset of monsoon and spraying with Bordeaux mixture 1.0% at periodical intervals depending upon weather conditions control the disease.
- Pruning and destruction of infected twigs followed by three to four sprays with Copper Oxychloride (COC) 0.3% + Streptocycline 100 ppm at monthly intervals after the onset of monsoon
- Spraying should be done immediately after the appearance of every new flush of leaves .the vigor of the plant should always be maintained by proper fertilization and irrigation.

➤The disease can be effectively controlled by spraying with streptomycin Sulphate 500 to 1,000 ppm at 15 days interval . the antibiotics are absorbed by leaves and translocated into the plant system .

➤Spraying with Neem cake solution has been found highly 5% effective in checking citrus canker as well as leaf miner . number of sprays for one year may range from 10 to 20 .

Greening

Symptoms: -

This disease affects almost all citrus varieties irrespective of rootstock.

➤ Stunting of leaf, sparse foliation, twig die-back, poor crop of predominantly greened and worthless fruits are important symptoms. A diversity of foliar chlorosis occurs.

➤ A type of molting position, become leathery and develop prominent veins and dull olive green color.

➤ Green circular dots are found on leaves. Many twigs become upright and produce smaller leaves.

➤ The side exposed to direct sunlight develops full orange colour but the other side remain dull olive green. Fruits are low in juice and soluble solids and high in acid. Fruits are worthless either as fresh fruit or for processing. Seeds are poorly developed, dark coloured and aborted.



Management:

- Removal of affected and unproductive trees and by replanting disease – free budded plants raised on rootstock.
- The insect vector can be controlled by spraying Monocrotophos 0.05 % at periodical intervals which help to check the spread of the disease.
- Tetracycline 500 ppm spray at fortnightly interval reduces the incidence by inhibiting the multiplication of the pathogen.

Tristeza/ Quick Decline

Symptoms :-

- Lime is susceptible both as seedling or budling on any rootstock. But mandarin and sweet orange seedlings or rough lemon, trifoliate orange and citringes and rangpur lime rootstock are tolerant.
- Susceptible rootstocks are grapefruit and sour orange. In sweet orange or mandarin, on susceptible rootstocks, leaves develop deficiency symptoms and abscise. rots decay, twigs die-back.
- Fruit set diminishes and only skeleton remain.
- Fine pitting is noticed on inner face of bark of sour orange stock. Fruits are small in size and insipid. Yield is highly reduced.

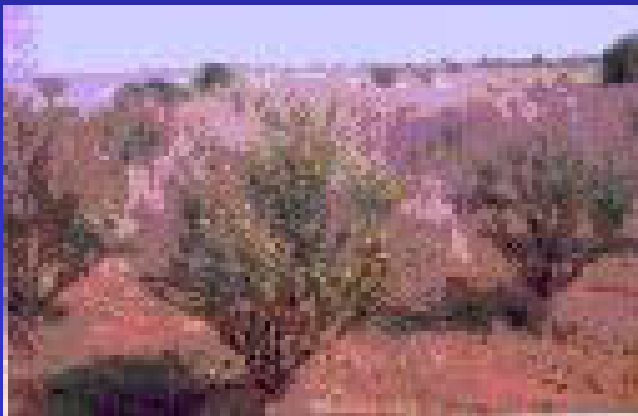


Management: -

- All diseased trees should be identified and removed as and when the disease is noticed.
- Fresh planting is done with virus free materials on tolerant rootstocks. For sweet orange and mandarins this method of management is highly useful.
- For acid lime, seedlings pre-immunized with mild strain of Tristeza virus is highly useful.
- Tristeza virus is not seed-borne. Hence nuclear seedlings which are virus –free and true to type can be used in the control of the disease. nuclear seedling of sweet orange remained free from infection for more than six years after planting. Periodical spraying of insecticides like Monocrotophos 0.05 per cent reduces the secondary spread of Tristeza in the orchard.

Citrus Decline and Management:

'citrus decline' is the most ominous problem in North-East India



Exocortis/ scaly Butt

- The plants show cracking and scaling of the bark.
- Scaling is characterized by narrow vertical strips of the outer portion of the bark.
- This symptom appears first on the rootstock near the soil line and gradually extends upward to the bud union and soon to the roots.
- Bark becomes dead and dries. Diseased trees are stunted. Normally trifoliate orange root stock overgrows the scion three or four years after budding.



Management

- **Removal of unproductive trees and replanting**
- **Viroid free certified bud woods on tolerant rootstocks such as; rough lemon, Cleopatra mandarin, sweet orange and sour orange are recommended.**
- **Budding knives should be cleaned and periodically washed with Trisodium phosphate soap solution.**

Post Harvest Diseases

Sooty Mold: *Capnodium citri*



Symptoms: A sooty black coating develops on leaves and twigs and sometimes on the fruit also. The root-cause of the disease is the infestation of tree with aphids and scale insects. The intensity and extent of this sooty growth is proportional to the intensity of insect infestation. The fungus grows on the honey dew secretion of insects. Ants may help in the spread of insects and fungus. Though the fungus does not affect the tree directly it may reduce the amount of sun light falling on the leaves. the trees present a sickly appearance and the fruits reduced in size

Management:

-Spraying the plant with fish oil resin soap or crude oil emulsion and starch (250g: 250g: 450 l water) will control the insect as well as remove the entire surface grown fungus mat, which will come off as flakes in due course.

-Dusting sulphur will also be helpful in the control of sooty mold.

Blue & Green Mould

Symptoms:

- Softening of damaged tissue.
- White fungal growth, which progressively turns blue or green as spores develop on fruit.
- Post harvest fungicides (Imazalil) can arrest spore development resulting in white only fungal growth.



Management:

- **Careful handling reduces damage to rind.**
- **Good hygiene and sorting reduces spore load and infection rates.**
- **Sanitation destroys spores in re-circulating water and packing line equipment.**
- **Post harvest fungicides should be applied within 24h of harvest.**
- **Lower storage temperatures slow down fungal development.**

References

<http://nrccitrus.nic.in/Project2.html>

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