

Citrus information kit

Reprint – information current in 1997



REPRINT INFORMATION – PLEASE READ!

For updated information please call 13 25 23 or visit the website www.dpi.qld.gov.au

This publication has been reprinted as a digital book without any changes to the content published in 1997. We advise readers to take particular note of the areas most likely to be out-of-date and so requiring further research:

- Chemical recommendations—check with an agronomist or Infopest www.infopest.qld.gov.au
- Financial information—costs and returns listed in this publication are out of date. Please contact an adviser or industry body to assist with identifying more current figures.
- Varieties—new varieties are likely to be available and some older varieties may no longer be recommended. Check with an agronomist, call the Business Information Centre on 13 25 23, visit our website www.dpi.qld.gov.au or contact the industry body.
- Contacts—many of the contact details may have changed and there could be several new contacts available. The industry organisation may be able to assist you to find the information or services you require.
- Organisation names—most government agencies referred to in this publication have had name changes. Contact the Business Information Centre on 13 25 23 or the industry organisation to find out the current name and contact details for these agencies.
- Additional information—many other sources of information are now available for each crop. Contact an agronomist, Business Information Centre on 13 25 23 or the industry organisation for other suggested reading.

Even with these limitations we believe this information kit provides important and valuable information for intending and existing growers.

This publication was last revised in 1997. The information is not current and the accuracy of the information cannot be guaranteed by the State of Queensland.

This information has been made available to assist users to identify issues involved in the production of citrus. This information is not to be used or relied upon by users for any purpose which may expose the user or any other person to loss or damage. Users should conduct their own inquiries and rely on their own independent professional advice.

While every care has been taken in preparing this publication, the State of Queensland accepts no responsibility for decisions or actions taken as a result of any data, information, statement or advice, expressed or implied, contained in this publication.



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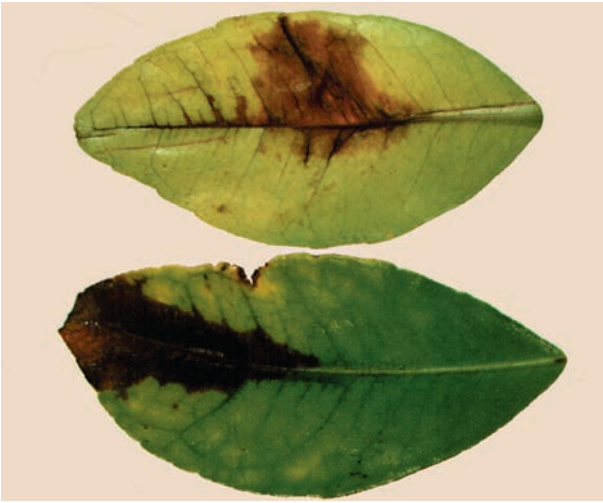
Problem **SOLVER**

Every crop will inevitably have a problem or two. The key to dealing with problems is prompt identification, and where appropriate, prompt treatment. This section helps you with both of these decisions. The common problems are shown in a series of pictures, grouped according to the main symptom. From the contents, find the symptom that best fits your problem. On that page, you will find pictures, causes and solutions for the problem.

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Spots or marks on leaves



1. Brown spot disease of mandarin

Cause. The fungus *Alternaria alternata*.

Solution. Needs regular spraying in Emperor, Murcott and Nova mandarins. In non-bearing trees, spray with an appropriate chemical from the *Problem Solver Handy Guide*. Follow label directions. Spray each new flush of leaves from September to April when flush is three-quarters expanded. In bearing trees, spray with a mixture of copper oxychloride (375 g), zinc sulphate heptahydrate (500 g), caustic soda (140 g) and white oil (625 mL) in 100 L water. Spray each new flush of leaves as above.



2. Melanose disease

Leaves have a sand-papery feel.

Cause. The fungus *Diaporthe citri*.

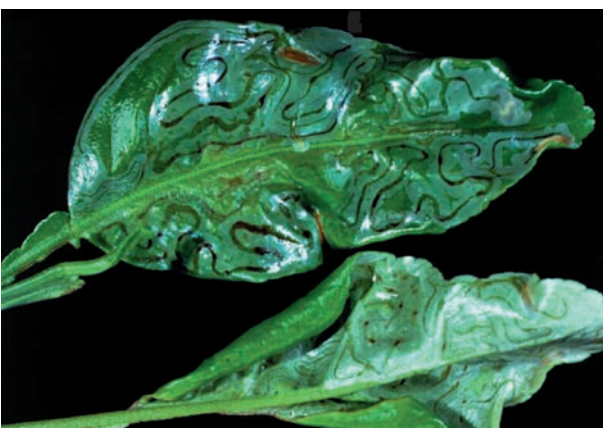
Solution. There is no immediate cure for affected trees. In future, spray trees with an appropriate chemical from the *Problem Solver Handy Guide* at half to three-quarters petal fall (mid to late September). Follow label directions. Timing is critical as sprays at other times of the year have no effect on the disease.



3. Scab disease of lemon

Cause. The fungus *Elsinoe fawcettii*.

Solution. There is no immediate cure for affected trees. In future, spray trees with an appropriate chemical from the *Problem Solver Handy Guide* at half to three-quarters petal fall (mid to late September). Follow label directions. Timing is critical as sprays at other times of the year have no effect on the disease.



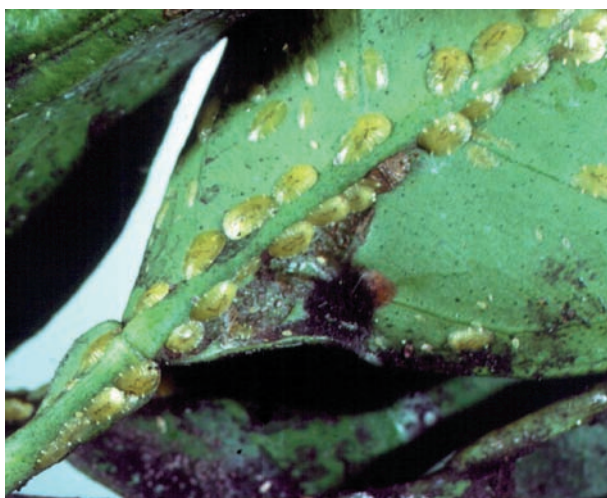
4. Citrus leafminer

Note the leaf distortion as well as the leaf markings.

Cause. The insect *Phyllocnistis citrella*.

Solution. Control is only required on trees up to four years old and then only on significant growth flushes between January and March. Spray each flush with an appropriate chemical from the *Problem Solver Handy Guide*. Follow label directions. Spray when the new leaves are just emerging (10 to 20 mm long).

Black soot and raised lumps on leaves



5. Sooty mould associated with scale insects

Upper: green coffee scale. Lower: pink wax scale.

Cause. Soft scale insects. The two common ones pictured here are *Coccus viridis* (green coffee scale) and *Ceroplastes rubens* (pink wax scale).

Solution. The best time to treat the problem is in late October to late November when the scales are most vulnerable. At this time, first check that scale populations are high enough to warrant treatment. The action level is 5% of twigs or leaves infested with scales. If treatment is required, there are two options. The first is to spray in late November with an appropriate chemical from the *Problem Solver Handy Guide*. Follow label directions. Addition of oil to the spray is optional. The other option is to spray twice with oil alone, once in late October and again in mid to late November. Details of oil sprays are contained in the *Problem Solver Handy Guide*. Follow label directions. At other times of the year, spray with the chemical alone. Also talk to a citrus pest consultant about using integrated pest management (IPM).

Brown tips on leaves



6. Salt burn

Cause. Either irrigation with salty water or excessive application of fertiliser.

Solution. Try to work out the source of the salt problem. The most common source is salty irrigation water. Get a water analysis done to check this. If the test is OK, get your fertiliser rates checked by a citrus consultant. If irrigation water is confirmed as being salty, apply it through under-tree sprinklers or trickle systems rather than through overhead sprinklers.

Yellow leaves – 1



7. Zinc or manganese deficiency

It is difficult to distinguish between these deficiencies in the field.

Cause. Deficiencies of zinc or manganese or both in the soil.

Solution. First get a leaf analysis done to confirm which nutrient is responsible. If the problem is zinc deficiency, spray trees with zinc sulphate heptahydrate at 100 g/100 L water. The spray can be applied with the copper spray normally applied in mid to late September for the control of black spot, melanose and scab. If the problem is manganese deficiency, spray trees with a mixture of manganese sulphate (100 g) and urea (700 g) in 100 L water. This deficiency is rare where mancozeb is used for black spot control. In future, do regular leaf and soil analysis.



8. Magnesium deficiency

Note how the yellowing occurs on the leaf edges while the centres remain green.

Cause. Deficiency of magnesium in the soil.

Solution. First get a leaf analysis done to confirm your diagnosis. Check soil pH and if it is less than 6.0, apply dolomite under the trees. If pH is above 6.0, spray trees with a mixture of magnesium sulphate (Epsom salts) (1000 g) and calcium nitrate (800 g) in 100 L water. An alternative is magnesium nitrate at 1500 g/100 L water. In future, do regular leaf and soil analysis.

Yellow leaves – 2



9. Iron deficiency

Upper: overall view. Lower: close-up of affected leaves. Note that affected leaves have an overall yellow colour as distinct from zinc, manganese and magnesium deficiencies and winter yellows. However, crotch rot, root rot and collar rot may cause similar yellowing. See pictures of these problems elsewhere in this section.

Cause. Deficiency of iron in young leaves. Generally caused by application of excessive amounts of liming materials.

Solution. First try to confirm that iron deficiency is responsible for the problem. You can eliminate crotch rot and collar rot as causes by looking for the characteristic cracking and lifting of the bark on the trunk. If these are absent, iron deficiency is likely. Check soil pH as it is likely that a temporary rise in pH from liming materials is causing the problem. Little needs to be done if this is the case. Otherwise, seek professional advice from a fertiliser agronomist or a citrus consultant.



10. Winter yellows or nitrogen deficiency

Upper: overall view of an affected tree. Lower: close-up of an affected leaf. Note how the veins have gone yellow.

Cause. The cause of winter yellows is unknown. The nitrogen deficiency symptom normally results from root damage.

Solution. Winter yellows sometimes occurs in young vigorous trees in autumn for no apparent reason. These trees generally recover by the next summer. Check to see if there are any causes of root damage. Apply nitrogen fertilisers regularly from September to April in young trees and in June/July in bearing trees. Use rates as recommended by leaf and soil analysis.

Dead areas on twigs and branches



11. Brown spot disease

Note the blackening and death of the tips.

Cause. The fungus *Alternaria alternata*.

Solution. Follow the recommendations for brown spot disease on page 2 of this section.



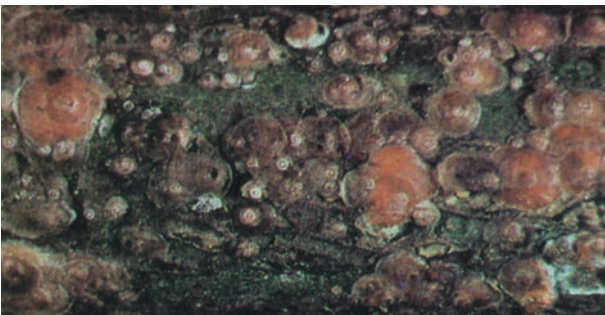
12. Brown rot disease

Brown spot and anthracnose may cause similar symptoms.

Cause. The fungus *Phytophthora citrophthora*.

Solution. Mostly a problem between December and April in wetter coastal areas. The phosphorous acid treatment for root rot and collar rot provides very effective control of brown rot. See page 23 for details of this treatment. Reduce soil splash from under trees by maintaining a mulch or ground cover. Also minimise soil being carried up into the trees on pickers' boots and ladders.

Raised lumps and scales on twigs and branches



13. Red scale

Cause. The insect *Aonidiella aurantii*.

Solution. The best time to treat the problem is in November/December when the scales are most vulnerable. First check that populations are high enough to warrant treatment. The action level is 5% of twigs or leaves infested. If treatment is required, follow recommendations for red scale on fruit on page 9.



14. White louse scale

Upper: overall view. Lower: close-up of the scales (magnified). A larva (left) and adult of the *Chilocorus* beetle, an important predator of the scale, are shown in the photo.

Cause. The insect *Unaspis citri*.

Solution. In well managed orchards, the *Chilocorus* beetle normally keeps white louse under effective control. However, if an infestation becomes as serious as that pictured and bark splitting begins to occur, spray with an appropriate chemical from the *Problem Solver Handy Guide* together with oil. Follow label directions. Apply two sprays, one month apart, in November/December. Thorough wetting of the affected areas is essential.



Swellings on twigs and branches



15. Citrus gall wasp

Cause. The insect *Bruchophagus fellis*.

Solution. Treatment is only required where more than one in three twigs are galled. Spray trees in the last week of November/first week of December with an appropriate chemical from the *Problem Solver Handy Guide*. Follow label directions. Add oil or a wetter where directed. Timing is critical. If the problem is severe, it means that beneficial insects have been significantly disrupted. Advice from a citrus pest consultant is recommended.

Cracking bark on trunks – 1



16. Collar rot

Left: overall view. Right: bark removed to show the brown discolouration of the wood.

Cause. The fungus *Phytophthora nicotianae*.

Solution. Mostly a problem in wetter coastal areas. Treat as recommended on page 23 of this section.



17. White louse scale

Cause. The insect *Unapsis citri*.

Solution. Treat as recommended on page 6 of this section.



18. Borer damage

Left: fig longicorn beetle damage. Most common in limes. Right: speckled longicorn beetle damage. Note the insect frass and sawdust associated with the damage. Most common in old Navel orange trees.

Cause. The insects *Acalolepta vastator* (fig longicorn) and *Paradisterna plumifera* (speckled longicorn).

Solution. First cut out dead limbs and scrape away the insect frass and sawdust. There are no chemicals specifically registered for borer control. Spraying affected areas as for white louse scale provides a measure of control. Use a high volume spray to thoroughly soak affected areas.

Cracking bark on trunks – 2



19. Crotch rot of Hickson mandarin

Note how the cracking extends from the crotch and not from the collar as in collar rot.

Cause. The fungus *Diaporthe citri*.

Solution. Mostly a problem in wetter coastal areas. There is no specific treatment for this problem. Sprays of copper and mancozeb, applied for black spot, melanose and scab, help to reduce its severity provided the sprays are applied in large volumes of water and directed to the trunk and branches as well as the leaves.



20. Shell bark of lemon

Cause. Unknown.

Solution. There is no appropriate treatment for this problem. In most cases, affected trees keep growing and may not decline for a number of years.



21. Scaly butt disease

Note that the cracking and scaling occur on the rootstock only. Confined to trees grafted to trifoliata and citrange rootstocks.

Cause. *Citrus exocortis* viroid.

Solution. There is no treatment for this problem. In future, ensure that all trees are propagated from indexed disease-free material.

Raised lumps or scabs on fruit



22. Red scale

Upper: overall view of affected fruit. Lower: close-up of scale.

Cause. The insect *Aonidiella aurantii*.

Solution. The best time to treat the problem is in November/December when the scales are most vulnerable. At this time, first check that scale populations are high enough to warrant treatment. The action level is 10 to 20% of fruit infested with live scales. If treatment is required, there are two options. The first is to spray with an appropriate chemical from the *Problem Solver Handy Guide* together with oil or a wetter. Follow label directions. The other option is to spray with oil alone. Details of oil sprays are contained in the *Problem Solver Handy Guide*. Follow label directions. Also talk to a citrus pest consultant about using predatory insects for red scale under an integrated pest management program. Do not use oil outside of the November/December period particularly for early varieties such as Navel orange and Imperial mandarin.

23. Scab disease of lemon

Cause. The fungus *Elsinoe fawcettii*.

Solution. There is no immediate cure for affected fruit. In future, spray trees with an appropriate chemical from the *Problem Solver Handy Guide* at half to three-quarters petal fall (mid to late September). Follow label directions. Timing is critical as sprays at other times of the year have no effect on the disease.

24. Brown spot disease of mandarin

Note that the spots are sunken but raised scabs form in the centres.

Cause. The fungus *Alternaria alternata*.

Solution. Needs regular spraying in Emperor, Murcott and Nova mandarins. In bearing trees, spray with a mixture of copper oxychloride (375 g), zinc sulphate heptahydrate (500 g), caustic soda (140 g) and white oil (625 mL) in 100 L water. Spray each new flush of leaves from September to April when flush is three-quarters expanded.

More or less circular black spots on fruit – 1



25. Black spot disease

Top: speckled blotch symptom. Centre: freckle spot symptom. Bottom: hard spot symptom.

Cause. The fungus *Guignardia citricarpa*.

Solution. There is no immediate cure for affected fruit. In future, spray trees with a copper and oil spray at half to three-quarters petal fall (mid to late September). Details of appropriate copper and oil products are contained in the *Problem Solver Handy Guide*. Follow label directions. Timing is critical. Follow up this initial spray with two additional sprays at six and twelve weeks after the first spray. A non-copper fungicide may be substituted for copper for these two sprays. This is preferred as copper sprays darken any injuries to the skin. Details of non-copper alternatives are contained in the *Problem Solver Handy Guide*. Follow label directions.



26. Melanose disease

Flyspeck symptom.

Cause. The fungus *Diaporthe citri*.

Solution. There is no immediate cure for affected fruit. In future, spray trees with a copper and oil spray at half to three-quarters petal fall (mid to late September). Details of appropriate copper and oil products are contained in the *Problem Solver Handy Guide*. Follow label directions. Timing is critical as sprays at other times of the year have no effect on the disease.

More or less circular black spots on fruit–2

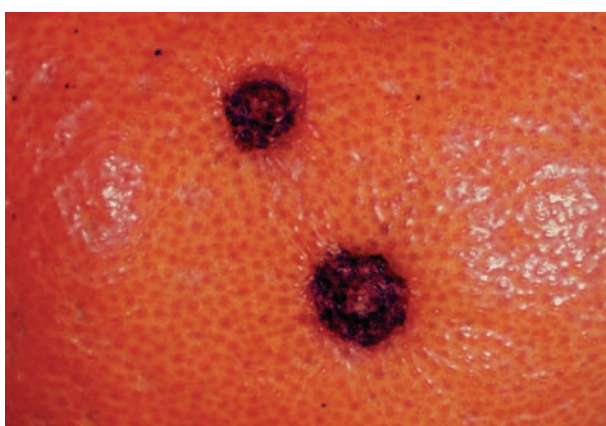


27. Spined citrus bug

Top: typical damage. Centre: section of damaged fruit showing brown areas in the rind caused by insect feeding. Bottom: adult bug.

Cause. The insect *Biprorulus bibax*.

Solution. First make sure that the problem is serious enough to warrant treatment. An action level of 10% of trees infested with bugs is recommended. Where required, spray with an appropriate chemical from the *Problem Solver Handy Guide*. Follow label directions. The main period of bug activity is from December to harvest.



28. Brown spot disease of mandarin

Cause. The fungus *Alternaria alternata*.

Solution. Needs regular spraying in Emperor, Murcott and Nova mandarins. In bearing trees, spray with a mixture of copper oxychloride (375 g), zinc sulphate heptahydrate (500 g), caustic soda (140 g) and white oil (625 mL) in 100 L water. Spray each new flush of leaves from September to April when flush is three-quarters expanded.



29. Hail damage

Cause. Impact from hailstones.

Solution. Treatment is not practicable.

Spots or marks of irregular size and shape on



30. Queensland fruit fly

Upper: sting marks on fruit. Lower: adult fruit fly.

Cause. The insect *Bactrocera tryoni*.

Solution. Start a fruit fly control program using fruit fly bait sprays. Ideally, this needs to commence in October for Meyer lemon and in January/February for most other varieties. Continue through until harvest. Spray once a week, and twice a week if it is wet and flies are active. This can be monitored with traps or by close observation of trees for presence of flies. The bait spray is applied as a coarse spray in a narrow strip to the lower leaf skirt of the tree. The bait spray is made up by mixing an appropriate chemical from the *Problem Solver Handy Guide* with yeast autolysate and water. Follow label directions. Apply 50 to 100 mL of bait spray per tree.



31. Fruit sucking moth

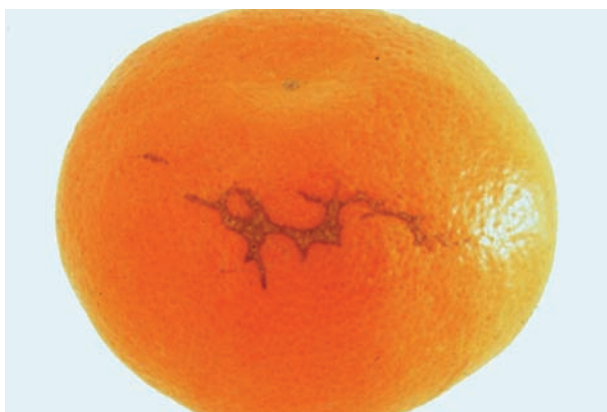
Upper: feeding site damage. Lower: adult moth. It is important to discern moth damage from that of fruit fly. Presence of fruit fly maggots in the affected area is the most obvious means of distinguishing between the two. Moth damage also consists of a more noticeable hole with the removal of underlying juice.

Cause. The insects *Othreis spp.* Imperial mandarin, Navel orange and grapefruit are most commonly affected.

Solution. First make sure that the damage is serious enough to warrant treatment. An action level of 5% affected fruit is recommended. Monitor damage weekly during the critical period from February to April and spray the two edge rows adjacent to the moth entry point as damage warrants. There is no chemical specifically registered for control of fruit sucking moth. However, the chemical methomyl, (for trade names see the *Problem Solver Handy Guide*) as recommended for control of citrus butterflies provides a measure of control for fruit sucking moth. Follow label directions.



Spots or marks of irregular size and shape on



32. Wind rub

Cause. Abrasion of fruit by twigs and leaves during windy weather.

Solution. Improve windbreaks around the orchard. Regularly prune trees to remove crowded branches. Using non-copper alternatives for the second and third black spot sprays will help reduce darkening of the damage on the fruit skin.



33. Spray damage

This is one of many symptoms produced from spray damage. These can range from dark flecks and scarring to uneven colouring of fruit during degreening.

Cause. Problems with incorrect chemical rates, application, compatibility and environmental conditions.

Solution. Check that chemicals you are using are registered and are being applied at the correct rates. If using mixtures of chemicals, check labels to make sure they are compatible. Calibrate your sprayer to make sure it is applying the right amount of chemical per hectare. Spray during the morning and early afternoon when the spray dries more quickly. Get some professional advice from a citrus pest consultant. If Nu-film is being used, sprays must be high volume sprays.



34. Oleocellosis (oil cell damage)

Upper: severe symptom. Lower: mild symptom. Note that jassid damage looks similar to mild oleocellosis. The condition is also similar to degreening burn (see page 17 of this section).

Cause. Damage to rind by oil released from oil cells. Generally occurs from pressure on the skin under cold or wet conditions.

Solution. Avoid harvesting fruit in the early morning when humidity is high. Avoid rough handling of fruit. Do not pick wet or immature fruit. Treatment with gibberellic acid for management of rind ageing also helps to reduce the risk of damage. Jassids are difficult to control with currently available chemicals. Seek professional advice from a citrus pest consultant.



Spots or marks of irregular size and shape on



35. Sunburn

Cause. Exposure of fruit to the western sun under hot conditions. Occurs mostly during January/February. A major problem in Murcott mandarin because of its terminal fruiting habit.

Solution. The only practical solution is to manage thinning operations to allow a final thin of damaged fruit in late February after the main risk period has passed. Seek professional advice on this from a citrus consultant.



36. Sour rot disease

Cause. The fungus *Geotrichum candidum*.

Solution. Avoid rough handling of fruit. Dip fruit within 24 hours of harvest in an appropriate chemical from the *Problem Solver Handy Guide*. Follow label directions. Dip for 30 seconds. Dip solution must be kept agitated at all times.



37. Netting

Cause. Unknown but believed to be fine abrasion damage during the early stages of fruit development.

Solution. Improve windbreaks around the orchard. Regularly prune trees to remove crowded branches. Using non-copper alternatives for the second and third black spot sprays will help reduce darkening of the damage on the fruit skin.

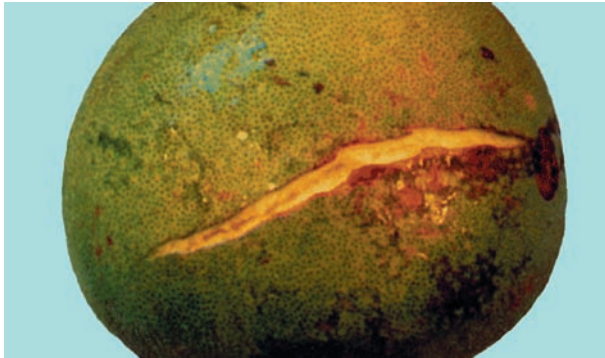


38. Stylar end rot

Cause. Unknown but believed to be associated with an interaction between fruit maturity and water and nutrient status. Problem only in limes and occasionally lemons.

Solution. In limes, harvest fruit before the skin colour changes from green to yellow. Avoid water stress close to harvesting.

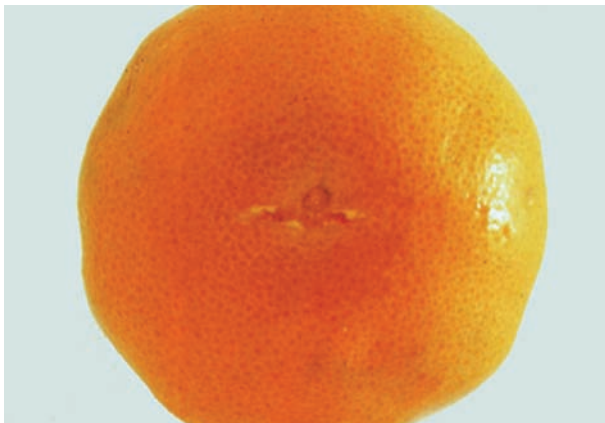
Split or creased fruit



39. Fruit splitting

Cause. Uneven soil moisture.

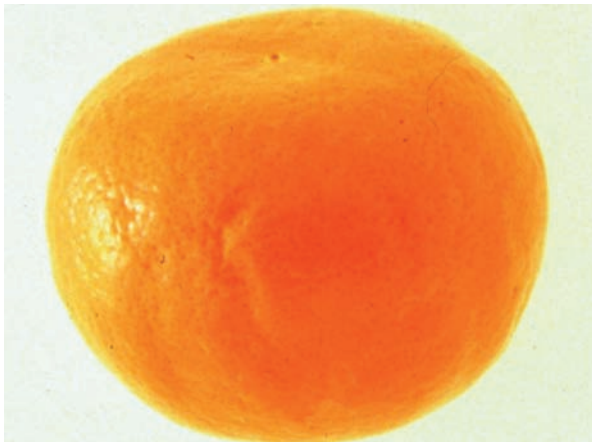
Solution. Water trees regularly to maintain even soil moisture in the root zone. A critical period is during the fruit set period in September/October. Use tensiometers, neutron probes or Enviroscans to help monitor soil moisture more effectively throughout the season.



40. Blossom end splitting

Cause. Moisture stress close to harvesting.

Solution. Water trees regularly to maintain even soil moisture in the root zone. Use tensiometers, neutron probes or Enviroscans to help monitor soil moisture more effectively close to harvesting.



41. Creasing

Cause. Exact cause unknown but believed to be associated with a deficiency of calcium or boron and extreme variation in soil moisture during the growing period. More serious in over-mature fruit. The condition is greatly influenced by tree age and rootstock.

Solution. Do regular leaf and soil analysis to monitor calcium and boron levels. Water trees regularly to maintain even soil moisture. Use tensiometers, neutron probes or Enviroscans to help monitor soil moisture more effectively. Harvest fruit as soon as it is mature.

Premature fall of fruit



42. Premature fruit fall

Cause. Uneven watering, mealybug damage, spined citrus bug damage or brown spot disease. Natural thinning of the crop may cause a similar fall of young fruit.

Solution. Check fallen fruit to see if there is any sign of mealybugs, spined citrus bug damage or brown spot disease. Pictures of these and what to do about them are contained elsewhere in this section. Water trees regularly to maintain even soil moisture in the root zone. Use tensiometers, neutron probes or Enviroscans to help monitor soil moisture more effectively.

Discolouration of skin of fruit – 1



43. Broad mite

Cause. The mite *Polyphagotarsonemus latus*. Mainly a problem on lemons and limes in coastal areas.

Solution. First make sure that the damage is serious enough to warrant treatment. An action level of 5% infested fruit is recommended. It is mainly a problem in young fruit up until it is about two-thirds grown. Spray as required from fruit set using an appropriate chemical from the *Problem Solver Handy Guide*. Follow label directions.



44. Rust mite

Upper: 'boot-polish' effect from severe attack. Lower: typical damage from brown citrus rust mite.

Cause. The mites *Phyllocoptruta oleivora* (citrus rust mite) and *Tegolophus australis* (brown citrus rust mite).

Solution. First make sure that the damage is serious enough to warrant treatment. An action level of 5 to 10% infested fruit is recommended. Spray as required from fruit set using an appropriate chemical from the *Problem Solver Handy Guide*. Follow label directions.



45. Black spot disease

Virulent spot symptom.

Cause. The fungus *Guignardia citricarpa*.

Solution. There is no immediate cure for affected fruit. In future, follow the spray program for this disease on page 10 of this section.



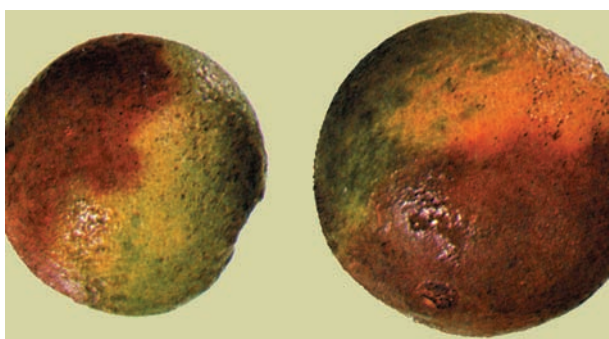
Discolouration of skin of fruit–2



46. Degreening burn (anthracnose)

Cause. The fungus *Colletotrichum spp.* in association with several predisposing factors including picking immature fruit, abnormal degreening conditions and moisture and nutrient imbalances close to harvest. The condition is similar to oleocellosis (see page 13 of this section).

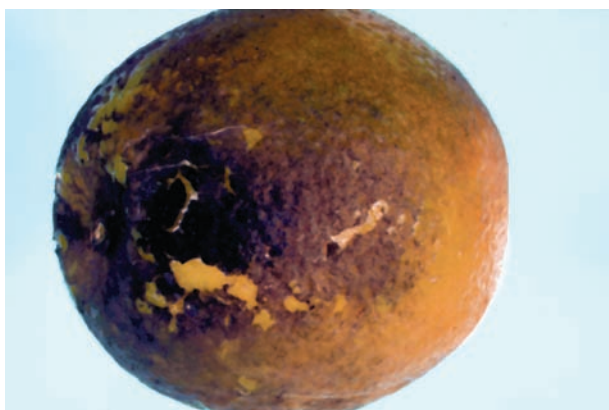
Solution. The problem can be minimised by avoiding picking immature fruit and carefully managing degreening duration, temperature and ethylene concentration. Also avoid over-fertilising with nitrogen fertiliser, and maintain even soil moisture close to harvest.



47. Brown rot disease

Cause. The fungus *Phytophthora citrophthora*.

Solution. Mostly a problem between December and April in wetter coastal areas. The phosphorous acid treatment for root rot and collar rot provides very effective control of brown rot. See page 23 for details of this treatment. Reduce soil splash from under trees by maintaining a mulch or ground cover. Also minimise soil being carried up into the trees on pickers' boots and ladders.



48. Sooty mould

Cause. Several dark coloured fungi growing on honey-dew exudates from scale insects, mealybugs, aphids and leafhoppers.

Solution. Control scale insects and mealybugs as recommended elsewhere in this section.



49. Melanose disease

Tearstain symptom grading into mudcake symptom (left).

Cause. The fungus *Diaporthe citri*.

Solution. There is no immediate cure for affected fruit. In future, spray trees with a copper and oil spray at half to three-quarters petal fall (mid to late September). Details of appropriate copper and oil products are contained in the *Problem Solver Handy Guide*. Follow label directions. Timing is critical as sprays at other times of the year have no effect on the disease.

Mould on skin of fruit



50. Blue and green mould disease

Cause. The fungi *Penicillium italicum* (blue mould) and *Penicillium digitatum* (green mould).

Solution. Handle fruit carefully during and after harvesting. Keep packing shed clean of damaged and mouldy fruit. Dip fruit within 24 hours of harvest in an appropriate chemical from the *Problem Solver Handy Guide*. Follow label directions. Dip fruit for 30 seconds. Keep dip solution agitated.

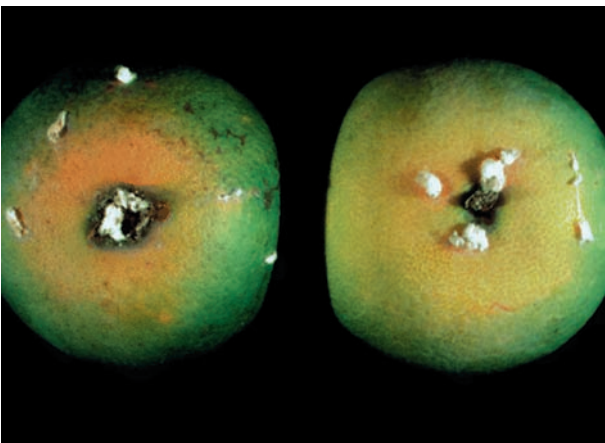


51. Brown rot disease

Cause. The fungus *Phytophthora citrophthora*.

Solution. Mostly a problem between December and April in wetter coastal areas. The phosphorous acid treatment for root rot and collar rot provides very effective control of brown rot. See page 23 for details of this treatment. Reduce soil splash from under trees by maintaining a mulch or ground cover. Also minimise soil being carried up into the trees on pickers' boots and ladders.

Discolouration around blossom-end of fruit



52. Navel end yellowing from mealybugs

Cause. The insect *Planococcus citri*.

Solution: First make sure that the damage is serious enough to warrant treatment. An action level of 10 to 20% of infested fruit is recommended. November is the critical time for action as it is very difficult to control this pest after this time. Spray as required using an appropriate chemical from the *Problem Solver Handy Guide*. Addition of oil or wetter is recommended for the November spray. Follow label directions. Consult a citrus pest consultant to discuss control of this pest under an IPM program.



53. Stylar end rot

Cause. Unknown but believed to be an interaction between fruit maturity and water and nutrient status. Problem only in limes and occasionally lemons.

Solution. In limes, harvest fruit before the skin changes from green to yellow. Avoid water stress.

Spots, marks or rots at stem end of fruit

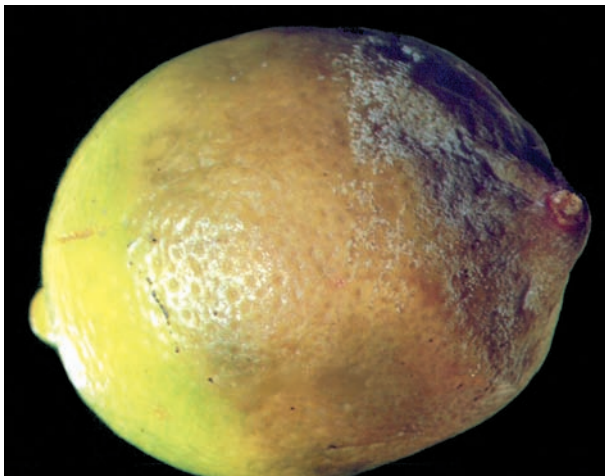


54. Centre rot disease

Upper: external symptom. Lower: internal rot.

Cause. The fungus *Alternaria alternata*.

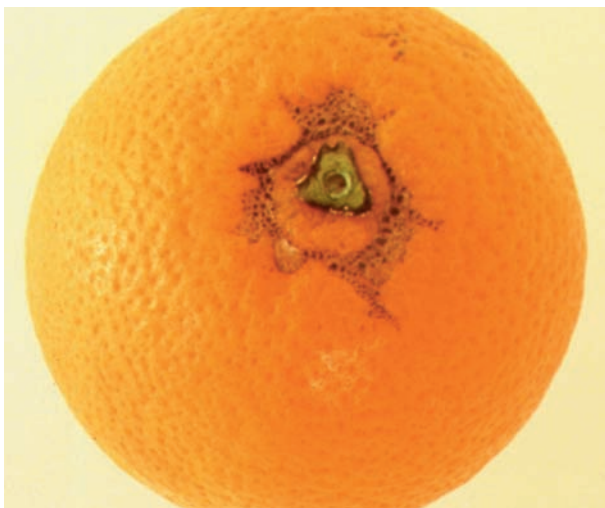
Solution. Problem only in stored fruit. If fruit is to be stored, include the chemical Cit-tite in the wax application. This treatment helps keep the button green to prevent the entry of the disease.



55. Stem end rot disease

Cause. The fungi *Diaporthe citri* and *Diplodia spp.*

Solution. Problem only in stored fruit. If fruit is to be stored, include the chemical Cit-tite in the wax application. This treatment helps keep the button green to prevent the entry of the disease.



56. Thrips damage

Cause. The insects *Scirtothrips spp.*

Solution. The critical period for damage is from petal fall to about November. If thrips are present, spray after petal fall as soon as bee activity during flowering has ceased. Then monitor young fruit for presence of thrips. An action level of 5% of infested fruit is recommended. Use an appropriate chemical from the *Problem Solver Handy Guide*. Follow label directions.

Distorted fruit

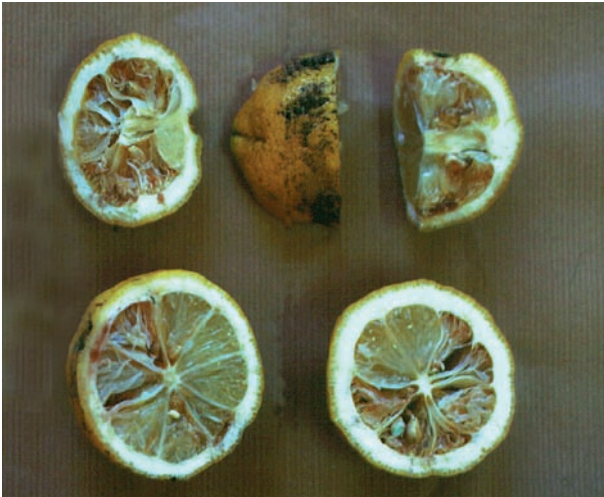


57. Boron deficiency

Top: affected fruit showing the lopsided growth effect. Centre: affected fruit showing distortion and internal dryness. Bottom: affected fruit often have pockets of gum in the rind.

Cause. Deficiency of boron in the soil.

Solution. First get a leaf analysis done to confirm your diagnosis. If boron deficiency is confirmed, spray trees with Solubor at a rate of 150 g/100 L water. In future, do regular leaf and soil analysis to monitor the levels of boron. Seek specialist advice from a fertiliser agronomist or a citrus consultant.



58. Bud mite

Cause. The mite *Eriophyes sheldoni*. Although severe symptoms as pictured here are rare, the pest can cause considerable problems in lemons, particularly the Lisbon variety. Buds on new shoots are often attacked, causing distortion and poor growth.

Solution. The program used for rust mite on page 16 normally keeps bud mite well controlled.

Stunting of trees



59. Stem pitting disease of grapefruit

Upper: stunted tree. Lower: grooving of the wood which can be seen when the bark is removed.

Cause. Citrus tristeza closterovirus.

Solution. There is no cure for affected trees. In future, ensure all new trees are propagated from pre-immunised material.



60. Scaly butt disease

Note that the scaling occurs on the rootstock only. Confined to trees grafted to trifoliata and citrange rootstocks.

Cause. Citrus exocortis viroid.

Solution. There is no treatment for this problem. In future, ensure that all new trees are propagated from indexed disease-free material.

Yellowing of whole tree

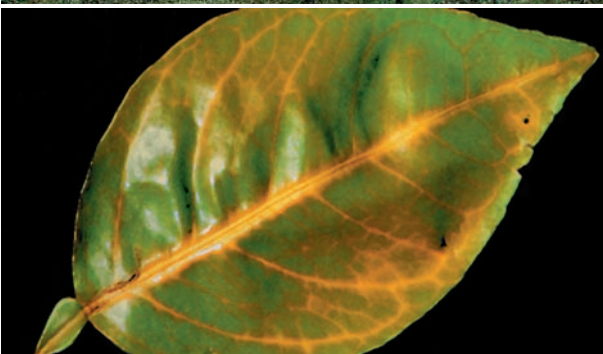


61. Crotch rot disease of Hickson mandarin

Upper: typically affected tree. Lower: close-up of the crotch rot.

Cause. The fungus *Diaporthe citri*.

Solution. Mostly a problem in wetter coastal areas. There is no specific treatment for this problem. Sprays of copper and mancozeb, applied for black spot, melanose and scab, help to reduce its severity provided the sprays are applied in large volumes of water and directed to the trunk and branches as well as the leaves.



62. Winter yellows or nitrogen deficiency

Upper: overall view of an affected tree. Lower: close-up of an affected leaf. Note how the veins have gone yellow.

Cause. The cause of winter yellows is unknown. The nitrogen deficiency symptom normally results from root damage.

Solution. Winter yellows sometimes occurs in young vigorous trees in autumn for no apparent reason. These trees generally recover by the next summer. Young mandarin trees up to about four years of age are most commonly affected. Check to see if there are any causes of root damage. Apply nitrogen fertilisers regularly from September to April in young trees and in June/July in bearing trees. Use rates as recommended by leaf and soil analysis.

Splitting of tree



63. Crotch weakness of Ellendale mandarin

Cause. Natural weakness of crotches under heavy fruit load.

Solution. Remove the fruit, lift the affected branches back into position and bolt the split areas back together. In future, run a wire around the outside of the branches lacing it through a few of the tree forks to hold it in place. Alternatively, prop up the branches with 50 mm by 25 mm hardwood props with a V cut in one end. Up to 10 props may be required for each tree.

Leaf fall and twig dieback



64. Root rot disease

Blight disorder and collar rot cause similar symptoms.

Cause. The fungi *Phytophthora nicotianae* and *Phytophthora citrophthora*.

Solution. First determine which of the three problems is responsible. Check the trunk for any evidence of collar rot (see below). If you can eliminate this, try injecting a hypodermic syringe of water into the sapwood of the trunk in late spring or summer. If you can't, the problem is most likely blight. There is no treatment for blight. This leaves root rot. For it, spray affected trees with a registered phosphorous acid preparation as for collar rot below. Don't overwater trees. Remove badly affected trees and replace with trees on resistant rootstocks.



65. Collar rot

Inset: bark removed to show the brown discolouration of the underlying wood.

Cause. The fungus *Phytophthora nicotianae*.

Solution. Mostly a problem in wetter coastal areas. Spray affected trees with a registered phosphorous acid preparation selected from the *Problem Solver Handy Guide*. Follow label directions. Spray twice a year, once in about late August prior to flowering and again in late March or April. A level of prevention can be obtained by spraying before the wet season with a copper fungicide selected from the *Problem Solver Handy Guide*. Follow label directions. So that marks on the fruit are not darkened by the copper spray, concentrate the spray to the trunk and the ground under the tree.

Dead branches on tree



66. Citrus branch borer

Top: affected tree showing dead branches. **Centre:** close-up of affected branch showing borer holes and chewed wood. **Bottom:** affected branch split to show larva and borer hole. An adult beetle is also pictured.

Cause. The insect *Uracanthus cryptophagus*.

Solution. It is very important to treat the problem before it has got too advanced. To do this, regularly check trees for the early stages of borer damage — a slight wilting of affected branches. Immediately remove these branches well below the area of leaf wilting. These can be left under the tree if it is only early damage but it is best to remove affected branches from the orchard and burn or bury them. Keep trees in a vigorous healthy condition as poor growth and twig dieback seem to predispose trees to borer attack. Orchards in wetter areas adjacent to rainforest are highly susceptible to attack. If possible, avoid growing citrus in these areas.

67. Pink disease

Cause. The fungus *Corticium salmonicolor*.

Solution. Generally only a problem in wetter coastal areas adjacent to rainforest. Prune out diseased branches as soon as they are detected and burn or bury prunings. Spraying with copper fungicides provides some protection against the disease. In future, inspect the orchard regularly for symptoms, particularly during the summer months.