

Mango information kit

Reprint – information current in 1999



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 1999. We advise readers to take particular note of the areas most likely to be out-of-date and so requiring further research: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- Financial information—costs and returns listed in this publication are out of date.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 1999. 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 mangoes. 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.



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 the causes and solutions.

Contents

Leaves	Spots or marks on leaves	2 – 3
	White patches on leaves.....	3
	Distorted leaves	4
	Holes in leaves.....	4
	Raised lumps on leaves	4
	Discoloured leaves	5
	Chewed leaves.....	5
	Yellow leaves.....	6
	Brown tips and edges on leaves	6
	Shoots	Young shoots wilted
Tree	Trees die	7
Flowers	Spotting and blackening of inflorescences	7 – 8
	Flowers webbed together	8
Fruit	Small fruit drop off.....	9
	Green fruit split.....	9
	Spots and marks on green fruit.....	10 – 11
	Spots and marks on ripening fruit (preharvest)	11 – 12
	Internal breakdown and discolouration	12 – 13
	Marks on the fruit skin.....	14 – 16
	Fruit stays green when ripe	16 – 17
Ripe fruit rots	18 – 20	

Spots or marks on leaves

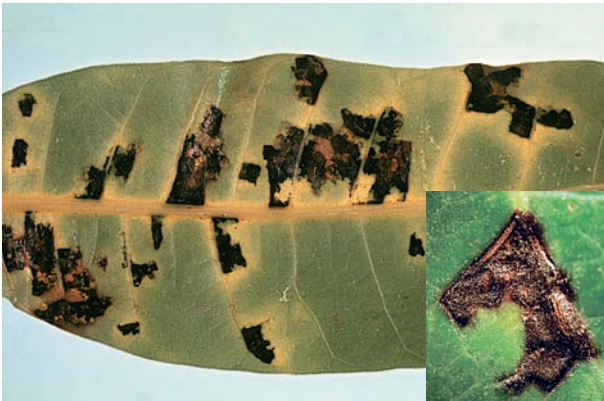


Anthracnose

Cause. The fungus *Colletotrichum gloeosporioides*. This disease is most severe during wet weather.

Solution. Minimise anthracnose problems by pruning to open the canopy to allow quicker drying of foliage and better spray penetration. Remove dead branches from the tree.

Chemical control measures are aimed at preventing the infection of fruit rather than leaves, but fruit sprays will protect the new shoots at the same time. Spray from flowering with an appropriate chemical from the *Problem solver handy guide*. Timing of sprays is dependent on weather conditions.



Bacterial black spot

The margins of black spot lesions are raised, with the edges defined by leaf veins. Inset: close-up of a lesion.

Cause. The bacterium *Xanthomonas campestris*. This disease can be severe in windy areas. The main cause of new infection is from planting diseased trees.

Solution. This disease requires a sustained long-term spray program with protectant fungicides to achieve effective control. Prevent initial infection by not planting diseased trees and providing adequate wind protection. Follow a control program using an appropriate chemical from the *Problem solver handy guide*.



Leafminer

The surface of the leaf becomes partially detached, giving it a blistered appearance.

Cause. Insects from the *Acrocercops* group feeding under the leaf surface.

Solution. Damage to older trees is usually insignificant, but control measures may be needed for young trees or trees that have just been topworked. Spray with an appropriate chemical from the *Problem solver handy guide* whenever fresh damage is observed. Insecticide sprays to control mango scale and tipborer will also control leafminer.

Spots or marks on leaves



Mango scab

Damage on older leaves shows as spotting.

Cause. The fungus *Elsinoë mangiferae*. Free moisture and high humidity favour the development of this disease.

Solution. Mango scab can be a problem in very young trees. If a regular fungicide spray program is used to control anthracnose, sprays to control scab should not be required. Protectant fungicide applications should start when inflorescences emerge and continue through early fruit set. Spray with an appropriate chemical from the *Problem solver handy guide*.



Mango scale

Note the large scales (female); elongated scales (male).

Cause. The insects *Aulacaspis tubercularis* and *Phenacaspis dilatata*.

Solution. There are some effective natural insect predators of scale, so scale problems can be aggravated by heavy insecticide use. To control scale, apply full cover sprays after pruning and when trees are flushing in February and March. Spray again in spring, no later than four weeks from harvest. Spray with an appropriate chemical from the *Problem solver handy guide*. Pruning the trees to improve spray penetration will help to minimise problems.



Algal spot

Cause. Several epiphytic types of green algae. The problem is worst in very wet and humid conditions.

Solution. Epiphytic algae cause little harm to mango trees and do not warrant the use of specific control measures. Pruning the trees to improve sunlight penetration and ventilation can help to reduce algal spot.

White patches on leaves



Powdery mildew

Young leaves are covered with a white powdery growth.

Cause. The fungus *Oidium* spp.

Solution. Powdery mildew control on leaves is not warranted. Sprays to control blossom blight or anthracnose on inflorescences will also control powdery mildew.

Distorted leaves



Herbicide damage

Leaves are thickened and can have a distorted, elongated, strap-like appearance.

Cause. Drift of herbicide spray containing glyphosate onto leaves of young trees.

Solution. When spraying with herbicides protect young trees to stop drift onto them. Spray at low pressure to avoid misting.



Mango scab

Leaves are distorted only when the disease affects fresh growth.

Cause. The fungus *Elsinoë mangiferae*. Free moisture and high humidity favour development of this disease. It can be a problem in very young trees in nurseries.

Solution. If conditions are conducive to fungal growth protect trees with a protectant fungicide to protect new shoot growth. Spray with an appropriate chemical from the *Problem solver handy guide*.

Holes in leaves



Boron deficiency

Cause. Insufficient boron in the soil.

Solution. Get a leaf tissue analysis done to confirm your diagnosis and apply the recommended rate of boron to correct the deficiency.

Raised lumps on leaves



Pink wax scale

Black sooty mould fungi are often associated with this pest.

Cause. The insect *Ceroplastes rubens*.

Solution. Spraying is rarely necessary because several natural parasites control this pest. Parasitised scales have a small hole on the top and are black inside. If parasites are not common on your orchard, collect leaves with parasitised scale from another area and hang these leaves in mesh bags in your trees.

Discoloured leaves



Sooty mould

The superficial black covering can be rubbed away to reveal undamaged tissue beneath. Upper: sooty mould on leaf; Lower: mango planthoppers are a common cause of sooty mould.

Cause. Usually fungi belonging to the order Dothideales.

Solution. The growth of these fungi is usually associated with scale insects or mango planthoppers, and is more serious under humid conditions. To control sooty mould you will need to control the insect that is causing the problem.

Redbanded thrips

The first sign of damage is a silverying of leaves, which develops to a pale yellow to brown in severe infestations. Leaves are also speckled with dried droppings.

Cause. The insect *Selenothrips rubrocinctus*.

Solution. Rarely severe enough to require spraying. If damage is observed on several trees, spray with an appropriate chemical from the *Problem solver handy guide*.

Tea red spider mite

Leaves turn a reddish brown as the mites destroy green tissue, with damage starting at the veins.

Cause. The insect *Oligonychus coffeae*.

Solution. Natural predators such as mite-eating ladybirds (*Stethorus* spp.) and predatory mites normally control this mite. Damage by this pest can be a sign of overuse of pesticides. Apply a recommended miticide from the *Problem solver handy guide* only when necessary.

Chewed leaves



Mango shoot caterpillar

Cause. Larvae of *Penicillaria jocosatrix*.

Solution. Spray with a recommended chemical from the *Problem solver handy guide* if large numbers of eggs or larvae are observed on leaves.

Yellow leaves



Nitrogen deficiency

Cause. Not enough nitrogen fertiliser applied.

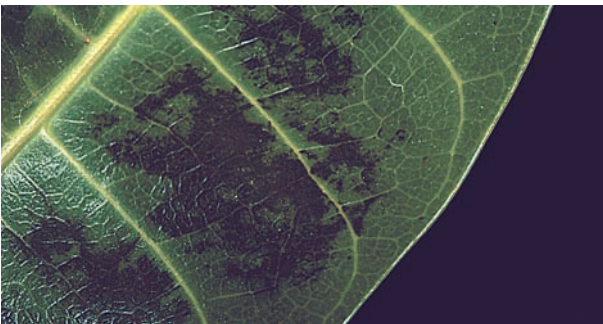
Solution. Confirm the diagnosis with a leaf tissue test. Increase the amount of nitrogen fertiliser applied to the trees according to the recommendation from the leaf test.

Water shortage

Cause. Not enough water available to the plant. Symptoms similar to nitrogen deficiency, mainly on older leaves.

Solution. Although mango trees are very tolerant of dry conditions, older leaves will turn yellow and fall if the tree is suffering from water shortage. Check your irrigation system and apply more water.

Brown tips and edges on leaves



Boron toxicity

Cause: Excessive application of boron fertiliser.

Solution: Boron is water-soluble and can be leached from the tree's root zone by heavy irrigation. Water heavily to leach the excessive levels of boron out of the root zone. Do not let the root zone dry out while the tree is showing symptoms of toxicity. Get a leaf tissue analysis done to confirm diagnosis.



Salinity

Cause: Irrigation water that is over 2 deciSiemens per metre can cause brown edges on the leaves.

Solution: Use another source of water if possible. If the water is on the borderline of acceptability, do not allow salts to build up in the soil. Water heavily to regularly leach salts from the root zone.

Young shoots wilted



Fruitspotting bug

Rapid wilting and death of young pink shoots. Very fresh damage shows as a dark stain on the stem.

Cause. Nymphs and adults of *Amblypelta lutescens* and *Amblypelta nitida*.

Solution. Inspect young shoots and inflorescences once a week for damage and bugs. Apply a full cover spray with recommended insecticides from the *Problem solver handy guide* whenever bugs or fresh injury are observed.

Young shoots wilted



Tipborer

Left: rapid wilting and death of young pink shoots. Right: new shoot showing the larval tunnel inside the stem.

Cause. Larvae of *Chlumetia euthysticha*.

Solution. Young trees and trees that have recently been topworked are particularly prone to setback following attack by tipborers while mature trees can tolerate some damage to postharvest shoot growth. Apply a full cover insecticide spray using an appropriate chemical from the *Problem solver handy guide* if larvae are observed in young shoots or inflorescences.

Trees die



Frost damage

Cause. Temperatures below 0°C.

Solution. Protect young trees during their first winter by wrapping their trunks in sisalation or similar insulating material. Another method is to irrigate for an hour or two until sunrise, just before the frost settles.



Termites

Cause. Feeding by certain species of termites.

Solution. There are currently no control measures for termites in mango orchards. If your trees are planted in an area prone to termites you should prepare the ground to destroy as many termite nests as possible before planting.

Spotting and blackening of inflorescences



Bacterial black blight

The discolouration and collapse of tissues is more extensive than for anthracnose.

Cause: The bacterium *Pseudomonas syringae*. This disease was first found in 1999 in South-East Queensland.

Solution: There are currently no control measures. If you believe you have this disease, contact your local DPI office to confirm the diagnosis.

Spotting and blackening of inflorescences



Powdery mildew

Healthy inflorescence on the right.

Cause. The fungus *Oidium* spp. that mainly occurs in cool dry weather, particularly when humidity is high.

Solution. Spraying with a recommended fungicide from the *Problem solver handy guide* when the first symptoms appear on the flowers will keep powdery mildew in check.



Anthracnose or blossom blight

The small black irregular spots spread to cause shedding and death of flowers, resulting in poor fruit set. Healthy inflorescence on the right.

Cause. The fungus *Colletotrichum gloeosporioides*.

Solution. Spraying with a protectant fungicide on a regular basis during flowering will reduce disease incidence. If there is rain at flowering, use a systemic fungicide in place of a protectant fungicide from the *Problem solver handy guide*.



Frost damage

Cause. Temperatures below 0°C.

Solution. Consider removing inflorescences if they are likely to flower during cold nights. This can promote a second flowering in more favourable temperature conditions.

Flowers webbed together



Flower eating caterpillar

During feeding larval webs cluster flowers together and the inflorescences become matted or balled with webbing, larval excreta and floral debris.

Cause. Larvae of moths from several insect families.

Solution. Only spray for flower caterpillars if the incidence of this pest is very high because of the adverse effect of pesticides on insect pollinators. Flower caterpillars are more of a problem on trees treated with a growth regulant such as Cultar®.

Small fruit drop off



Poor pollination

Cause. There are several causes of poor pollination. Temperatures below 12°C and the use of insecticides that reduce the numbers of insects visiting flowers are major causes. Low levels of boron are also associated with poor pollination. Fruitspotting bugs and anthracnose can be responsible for the abortion of very small fruitlets.

Solution. Determine the cause of your problem. If flowering is early and coincides with cold weather you may be able to remove those flowers to induce a second flowering. Avoid insecticide applications during flowering. Adjust boron application rates.



Anthracnose

Cause. The fungus *Colletotrichum gloeosporioides*.

Solution. This disease is most severe during wet weather. Control measures are aimed at preventing infection of fruit. Protect young fruit. Spray from flowering with an appropriate chemical from the *Problem solver handy guide*. Timing of sprays is dependent on weather conditions.



Fruitspotting bug

Cause. Nymphs and adults of *Amblypelta lutescens* and *Amblypelta nitida*.

Solution. Inspect young fruit and inflorescences once a week for bugs or signs of damage. A full cover spray with a recommended insecticide should be applied whenever bugs or fresh injury is observed.

Green fruit split



Bacterial black spot

Fruit will split if infected while still small.

Cause. The fungus *Xanthomonas campestris*.

Solution. Provide good protection from wind damage. Follow a preventative spray program using an appropriate chemical from the *Problem solver handy guide*.

Spots and marks on green fruit



Mango scab

Cause. The fungus *Elsinoë mangiferae*. Free moisture and high humidity favour development of this disease.

Solution. Spray trees with a protectant fungicide to protect new fruit and leaf flushes. A regular spray program for anthracnose control will also control mango scab. Spray with an appropriate chemical from the *Problem solver handy guide*.



Russet

Cause: The insect *Selenothrips rubrocinctus*.

Solution: Once the damage is visible it is too late to control the cause of the problem. In future monitor the flowers by shaking inflorescences onto a piece of white paper. If you see thrips on the paper and in the inflorescences, spray with an appropriate chemical from the *Problem solver handy guide*.



Sooty mould

Cause. Fungi growing on the secretions from sap-sucking insects such as scale or flatids.

Solution. Control the underlying cause of the problem such as scale with an appropriate chemical from the *Problem solver handy guide*.



Bacterial black spot

Cause. The fungus *Xanthomonas campestris*.

Solution. Provide good protection from wind damage. Follow a preventative spray program using an appropriate chemical from the *Problem solver handy guide*.



Wind rub

Cause: Fruit rubbing against leaves or dead twigs.

Solution: Plant windbreaks to reduce wind speed in the orchard and prune out dead wood.

Spots and marks on green fruit



Sunburn

The damage can vary from a bleached or yellow patch on the skin to severe cases in which the skin is leathery, yellow-brown to black and slightly depressed.

Cause. Damage results from very high temperatures on exposed fruit or from fruit suddenly being exposed to sunlight when branches are broken. Fruit on water-stressed trees will sunburn more easily. Harvested fruit left in direct sun may also burn.

Solution. Keep trees well watered during fruit filling. Avoid any tree damage that may expose fruit to the sun and keep fruit in the shade after harvest.



Mango scale

Cause. The insects *Aulacaspis tubercularis* and *Phenacaspis dilatata*.

Solution. There are a few natural predators of scale so scale problems can be aggravated where heavy insecticide use is practised. Apply full cover sprays when trees are flushing in February and March and again in spring no later than four weeks from harvest. Spray with an appropriate chemical from the *Problem solver handy guide*.

Postharvest pruning to open the canopy and improve ventilation and spray penetration will help to minimise problems.



Hail damage

Cause. Hail stones damaging green fruit.

Solution. In most situations it is not economical to provide hail protection for mango orchards. Damage may heal and this fruit can be sold for processing. However, if you sell into a high niche market, you could consider protection for hail and sunburn.

Spots and marks on ripening fruit (preharvest)



Anthracnose

Cause. The fungus *Colletotrichum gloeosporioides*.

Solution. This disease is most severe during wet weather. Control measures are aimed at preventing the infection of fruit. Protect young fruit. Spray from flowering with an appropriate chemical from the *Problem solver handy guide*. Timing of sprays is dependent on weather conditions.

Spots and marks on ripening fruit (preharvest)



Fruit fly

Cause. Several fruit fly species including *Dacus tryoni* and *Dacus neohumeralis* attack mangoes.

Solution. Gauge the level of fruit fly activity in the fruit fly traps. Spray when a sustained increase in numbers is noted or from six weeks before harvest. Spray with an appropriate chemical from the *Problem solver handy guide*. Some interstate markets require a preharvest and postharvest control program to meet quarantine requirements.



Fruitpiercing moth

Cause. The moths *Othreis fullonia* and *Othreis materna*.

Solution. Late maturing varieties of mango are more prone to attack. Inspect the trees nightly with a strong torch when the fruit is close to maturity. The eyes of the moths will reflect the torchlight. Hand collection of moths has had a limited success. There is no practical control measure.



Internal breakdown and discolouration



Jelly seed

The flesh around the seed disintegrates into a jelly-like mass. In severe cases, the entire fruit is affected. Affected flesh usually has an obnoxious smell and taste.

Cause. The cause of this disorder is not known. Some varieties are more susceptible than others.

Solution. This disorder shows no external symptoms. Jelly seed is uncommon in Kensington Pride but can be severe in Tommy Atkins and in Sensation. It is more prevalent in south-east Queensland than in other areas of Australia. Do not grow susceptible cultivars in districts that have a high incidence of jelly seed.

Internal breakdown and discolouration



Stem-end cavity

Upper: external symptoms. Lower: internal symptoms showing hollow in the stem end.

Cause. The cause of this disorder has not been conclusively established, although in some cases, the incidence has been reduced following pre-flowering soil applications of calcium.

Solution. Harvest fruit at the green mature stage, before they have started to ripen on the tree. Make sure they are fully mature before harvesting, so that they will be sweet when ripened. If ripening fruit are harvested, check their stem ends for discolouration and a spongy feel before packing. All fruit with stem-end cavity are unacceptable for marketing. Get a tissue analysis done and make sure that calcium and boron levels in the tree are within the correct range.



Soft nose

Cause. The cause of this disorder has not yet been clearly established. Kensington Pride is particularly susceptible.

Solution. Avoid the excessive use of nitrogen and ensure that both calcium and boron are fully supplied. Harvest fruit at the green mature stage, before they have started to ripen on the tree. Make sure they are mature before harvesting, so that they will be sweet when ripened. If ripening fruit are harvested, check the beak end for a spongy feel before packing.



Internal breakdown

Cause. The cause of this disorder has not yet been clearly established but trees with a light crop load are more likely to develop breakdown. Keitt is particularly susceptible.

Solution. Avoid the excessive use of nitrogen and ensure that both calcium and boron are fully supplied. Harvest the fruit before they become over mature. Harvest fruit at the green mature stage, before they have started to ripen on the tree. Make sure they are mature before harvesting, so that they will be sweet when ripened. If ripening fruit are harvested, check fruit for a spongy feel before packing.

Marks on the fruit skin

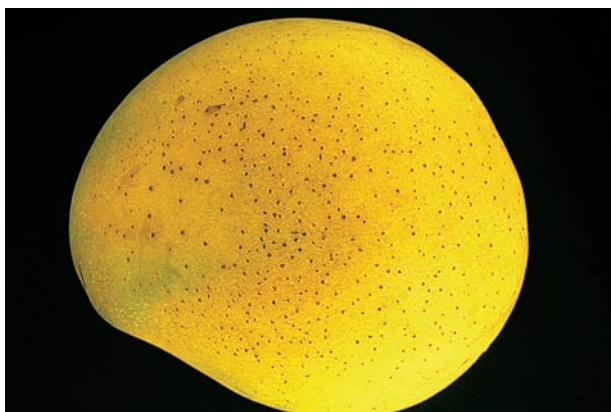


Chilling

Upper: mature green fruit showing blotchy areas of dull dark grey discoloration. Lower: ripe fruit chilling injury is seen as dark spotting of lenticels and skin dullness.

Cause. Storing mature green Kensington Pride fruit below 13°C. The lower the temperature, and the longer the time below 13°C, the more severe the symptoms.

Solution. Hold mature green fruit at temperatures above 13°C. To ripen fruit to an acceptable colour and flavour, hold them at 20 to 22°C. Ripe fruit can be stored down to 5°C, but for no more than three days.



Lenticel spot

The corky tissue in lenticels on the skin swells and then darkens, giving the fruit a spotted appearance. This becomes more obvious as the ripening fruit changes colour from green to yellow.

Cause. Lenticel spot is most often associated with an excessive immersion time in dips and with excessive detergent in the wash water.

Solution. Do not exceed the hot dipping time of five minutes and avoid immersion in water for more than 15 minutes.

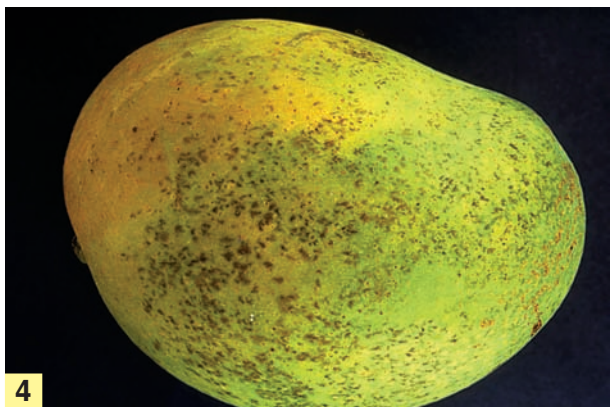
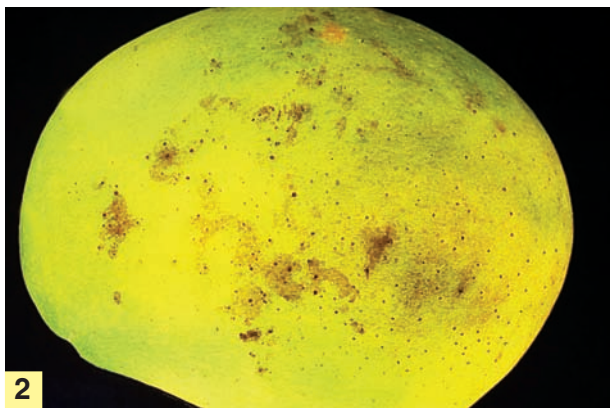
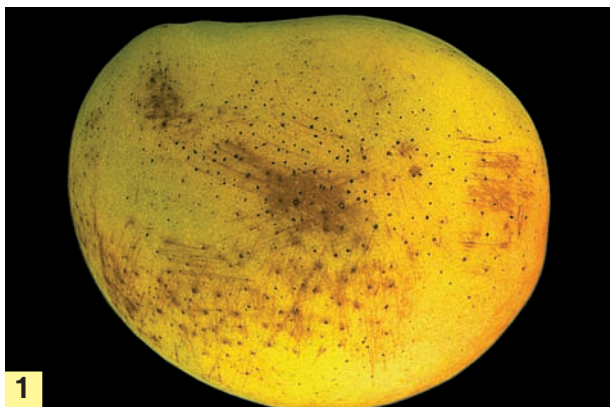


Sunburn

Cause. Leaving fruit in direct sun following harvest.

Solution. Do not leave fruit in direct sunlight following harvest.

Marks on the fruit skin



Skin browning

The blemish does not appear immediately. Fruit may be free of blemish in the grower’s packing shed, but appear blemished by the time it reaches the wholesaler or retailer.

1: Abrasion. 2: Smear. 3: Blotch. 4: Resin canal. 5: Spot. 6: Etch.

Cause. Damage to the skin of the fruit during harvest and packing will cause the range of skin blemishes known as skin browning. Damage can occur from bumping the fruit, heat, moisture, sap and abrasion caused by contact with dirt or rough surfaces.

Solution. Careful handling is necessary to avoid skin browning. Check your picking and packing procedures and identify areas where skin browning could occur. Develop a harvesting system to minimise the causes of skin browning. Train staff in handling procedures. Information on suitable harvesting and packing techniques can be found in Section 3 — *Harvesting techniques* and in Section 4 — *Preventing sapburn and skin browning*.



Marks on the fruit skin



Sapburn

The blemish does not appear for about 24 hours after sap has been in contact with the skin. Fruit may be free of blemish in the grower's packing shed, but appear blemished by the time it reaches the wholesaler or retailer. Special handling procedures are necessary to avoid sapburn injury after harvest.

Cause. Sap in contact with the fruit during harvesting and postharvest handling will cause skin blemish. Mango fruit release two types of sap after harvest.

Spurt sap is released rapidly within five seconds of removing the stem and causes the deep black burn on the skin.

Ooze sap is released more slowly over about one hour. This sap does not injure the skin directly, however, it can collect in the bottom of the package and remain as a clear sticky fluid on the fruit surface, detracting from its appearance.

The maturity of the fruit, the variety and the time of day for harvest affect the amount of sap exuded by a fruit. Kensington Pride is particularly susceptible to sapburn. The fruit tends to have more sap when it is less mature and earlier in the day.

Solution. Harvest fruit using practises that minimise skin contact with sap. Information on suitable harvesting and packing techniques can be found in Section 3—*Harvesting techniques*.

Fruit stays green when ripe



Bruising

Hard green fruit crack internally. Eating-ripe fruit bruise near the seed, where the flesh darkens and softens. Bruising can extend to the surface when the impact is severe. In softening fruit (but not eating-ripe), the bruised flesh fails to ripen and remains paler and firmer than undamaged tissue.

Cause. Fruit being dropped during harvesting and grading, packages being dropped and shocks during transport. The critical drop height at which fruit is damaged is 300 mm for hard green fruit and lower for softening fruit. The severity of damage increases with drop height.

Solution. Avoid dropping fruit or packages of fruit from a height greater than 300 mm during harvesting and handling. Reduce manual handling by palletising loads and choose packages that stack effectively on the pallet. Secure pallet loads properly during transport.

Fruit stays green when ripe



Abnormal ripening

Fruit ripens when green and develops unpleasant odours and flavours.

Cause. Lack of oxygen and build-up of carbon dioxide and other by-products of metabolism within the fruit caused by poorly managed controlled atmosphere (CA) storage. Wax coatings that restrict gas movement between the air and the fruit can also result in abnormal ripening. Oxygen levels below 4% and carbon dioxide levels above 12% will cause abnormal ripening.

Solution. Control of the atmosphere in CA storage must be precise. Maintain oxygen levels at 5% and carbon dioxide levels at less than 8% in the atmosphere around the fruit. Do not coat fruit with waxes or other materials.



Scalding

The symptoms of hot water scald are very similar to those of brushing damage. Ripening fruit appear to be more prone to damage than green mature fruit.

Cause. Scald develops if either the recommended temperature or dipping time is exceeded during postharvest dipping. If fruit are packed hot, the areas where they touch each other can develop scald.

Solution. Do not exceed the recommendations for duration of dipping or dip temperature. Check how quickly fruit is moving through the dip and make sure the dip is well circulated. Do not allow hot spots to develop in the tank close to the heating element. Cool fruit before packing.



Pressure

Mangoes become more susceptible to pressure bruising as they ripen. Hard green mangoes can be handled in bulk bins, but softening fruit will bruise if packed with more than three layers per carton.

Cause. The common causes of pressure damage are package collapse, over packing, and sagging of carton lids and bases.

Solution. Choose packages strong enough for the handling system. Ensure pallet loads are adequately secured using corner stays and straps or tension netting, or palletising glue and straps.

For single-layer packs, use an internal package depth of 105 mm and leave a 5 mm gap between the top of the fruit and the lid. This avoids over packing and allows for carton sag. For very large fruit (less than 10 per carton), a deeper package may be required.

Ripe fruit rots (postharvest)



Anthracnose

Left: untreated fruit. Right: treated in hot fungicide.

Cause. The fungus *Colletotrichum gloeosporioides*. Disease development after harvest is the result of infection of fruit on trees before harvest. The fungus may remain dormant in green fruit for many months.

Solution. Improve your preharvest spray program. Prune trees to improve ventilation and spray penetration. Remove dead branches from trees. Calibrate sprayer to make certain you are getting good coverage.

Temperature management of fruit is also critical in reducing postharvest problems. Make sure that fruit is cooled within 48 hours of harvest. Cool fruit to 13°C for storage and transportation. Ripen fruit at 20° to 22°C.

Apply a postharvest chemical treatment by dipping at 52°C for five minutes with an appropriate chemical from the *Problem solver handy guide*. You can also dip at 55°C for five minutes in hot water alone. Make sure that the postharvest treatment is applied at the correct temperature and according to label directions.

Marks on the fruit skin (postharvest)



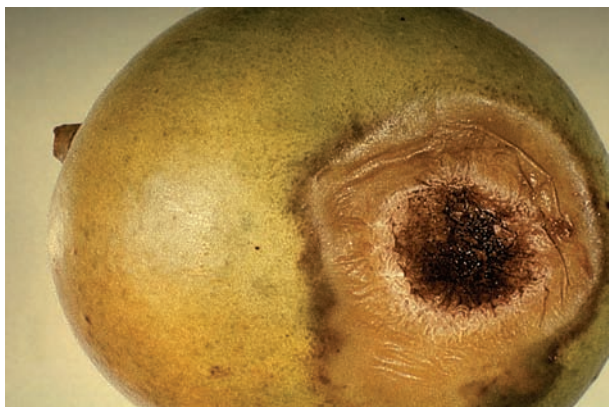
Alternaria rot

Cause. The fungus *Alternaria alternata*. The disease is unlikely to cause losses in fruit eaten within two weeks of harvest and is likely to be serious only after prolonged storage of fruit.

Solution. The preharvest and postharvest fungicide sprays applied to control anthracnose will also reduce alternaria rot.



Marks on the fruit skin (postharvest)



Aspergillus fruit rot / black mould

Cause. The fungus *Aspergillus niger*. Infection occurs through natural openings in the skin, wounds, or areas of the skin affected by sapburn.

Solution. Remove reject fruit from the packing shed and clean the shed and all equipment regularly. Use steam or high pressure hot water as well as a sanitising agent such as chlorine. Do not harvest immature fruit and handle fruit carefully to avoid damaging the skin. Do not allow fruit to come into contact with the ground.

No fungicides are registered for control of this disease in mangoes.



Stem-end rot

Symptoms appear as the fruit ripens. The decay starts at the stem end and spreads through the fruit. Some forms of stem-end fungi can also appear as spotting on the sides of the fruit.

Cause. The fungi *Dothiorella dominicana*, *Lasioidiplodia theobromae*, *Botryodiplodia theobromae* and *Phomopsis mangiferae*. These fungi are natural inhabitants on the branches of the mango tree and grow into the stem of the fruit before harvest. Fruit placed on the ground for desapping can also be infected from the bark, twig litter or the soil.

Solution. Preharvest sprays of fungicides to control bacterial black spot or anthracnose may reduce the incidence of stem-end rot in fruit. Prune trees to improve ventilation and spray penetration. Remove dead branches from trees. Avoid water stress during fruit development. Avoid harvesting immature fruit and cool fruit immediately after harvest and store in well-ventilated containers. Postharvest fungicide treatment also helps to reduce the incidence of stem-end rot.



Ripe fruit rots



Stemphylium rot

Cause. The fungus *Stemphylium vesicarium*.

Solution. No fungicides are registered for control of Stemphylium rot but hot water and fungicide treatments applied for anthracnose control will provide some control. The disease is unlikely to cause losses in fruit eaten within two weeks of harvest.



Grey mould

Cause. The fungus *Botrytis cinerea*. Infection occurs through damaged tissue or the remains of flowers and is favoured by cool storage conditions (13° to 20°C). Spores may carry over from other hosts such as tomatoes or strawberries that were previously stored in the container or cold room.

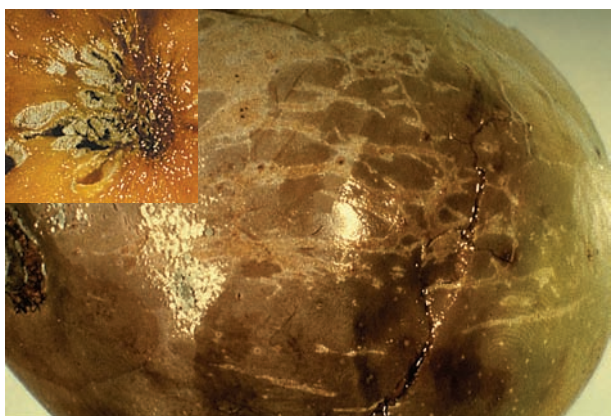
Solution. Avoid damage to fruit during harvest and packing. Make sure that packing sheds and storage facilities are kept clean and hygienic. Hot water and fungicide treatments applied for anthracnose control will provide some control of grey mould.



Mucor rot

Cause. The fungus *Mucor circinelloides*. Infection occurs through wounds or damaged tissue and is favoured by long-term cool storage in controlled atmospheres. Secondary spread may also occur during storage.

Solution. Avoid damage to fruit during harvest and packing. Do not allow fruit to come into contact with the ground as the fungus is widely found in soil and decaying organic matter. Make sure that packing sheds and storage facilities are kept clean and hygienic.



Blue mould

Inset: close-up of damage.

Cause. The fungus *Penicillium expansum*. Infection occurs through wounds and secondary spread may occur during storage.

Solution. Make sure that packing sheds and storage facilities are kept clean and hygienic. Avoid damaging fruit during harvest and packing. No specific fungicides are registered for control of blue mould on mangoes. Hot water and fungicide treatments applied for anthracnose control will provide some control of blue mould.