

Traditional orchards: fruit tree health

This information note provides guidance on identifying, and managing for, the main pests, disease and nutrient deficiencies that may affect a traditional orchard. Other notes in the series provide guidance on other aspects of traditional orchard management. For an explanation of terms used in this leaflet see note TIN021 *Orchard glossary*.

Key points

- The addition of nutrients, particularly artificial fertilisers, to the soil is usually unnecessary and may harm trees by disrupting their mycorrhizal associations.
- If fertilisers are applied they should be confined to below tree canopies rather than across the whole sward.
- Extensively managed, traditional standard orchards are less likely to suffer from significant pest and disease infestations or nutrient deficiencies than commercial bush tree orchards. However, problems can still occur.
- Pesticides and fungicides should only be used to control specific recorded pests and diseases.
- Organic methods of pest control, that depend on prevention rather than cure, are likely to be the least detrimental to wildlife.

Weed competition

Weed competition for water and nutrients can severely restrict growth and cropping of fruit trees, particularly young trees. The area around the base of a new tree should be kept weed free for at least three years after planting.

Rampant weed growth, especially dominant perennials such as bramble and other scrub, can also affect mature trees.

These should be kept under control and not allowed to overwhelm the orchard. In areas that need to be cleared the first step is to physically remove the growth, either by hand or mechanically. Subsequent control of re-growth may be by hand, machine or grazing. Chemical control through the use of herbicides should only be practised when absolutely necessary.

Nutrient status

The nutrient status of the soil can be determined by having it analysed. The pH, a measure of soil acidity, should ideally be between 6.0 and 6.5 for optimum fruit tree growth and production. If it falls outside this range nutrient deficiencies may be a problem. Fruit trees can be grown on a wide range of soils. Where trees show signs of deficiencies they can be remedied by the application of fertilisers, preferably organic. The most common nutrient deficiencies are detailed below.

Nutrient applications

The use of fertilisers should be considered carefully. Large and/or frequent applications will result in a decrease in the species diversity of grassland and may harm trees over time by interfering with their mycorrhizal associations. Applying nutrients can also stimulate soft, weak growth that is vulnerable to pests and disease.

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If fertilisers are used, slow release and organic fertilisers are better than instant-boost chemical fertilisers. Well-rotted farmyard manure is the best fertiliser.

Fertiliser application to unimproved grassland should be avoided as it may damage the botanical interest. Swards identified as having a particularly low organic content (often a result of hay cutting over a number of years) may benefit from an application of farmyard manure. Unimproved grasslands on neutral soils should receive an application of well-rotted farmyard manure not exceeding 20 tonnes/hectare every five years, and only 5 tonnes/hectare or less annually.

To protect the specialised floras on unimproved acidic and calcareous grasslands farmyard manure should not be used at all. Where trees show signs of nutrient deficiency on species-rich grassland, apply nutrients only around the base of young trees and below the canopy and particularly the drip line (the edge of the canopy) of older trees, leaving the bulk of the sward unfertilised.

Fruit trees and mycorrhizae

A tree's root system extends a long distance and over time develops associations with fungi called mycorrhizae. These beneficial fungi colonise the roots and help the tree by extending its root system into the surrounding soil, via an extensive network of thread-like filaments. There can be up to 20 metres of mycorrhizae filaments per teaspoon of soil. They extract nutrients and other elements from the soil and exchange these for carbon from the plant.

Mycorrhizae help maintain tree vigour by making nutrients and water available at times of stress, as well as acting as natural blocks to the passage of root pathogens.

The application of fertiliser can result in the loss of these mycorrhizal fungi as the trees abandon their associations in response to the temporary abundance of nutrients. Where an orchard has a history of being fertilised the mycorrhizae associations may not be established and in these situations fertiliser may continue to be used.

Mycorrhizal fungi operate within certain pH regimes, so liming (which raises the pH) can have a damaging effect on the mycorrhizae and should be avoided.

Nutrient deficiencies

Nutrient shortages show as recognisable signs on the foliage. This indicates the need to correct the problem. If a deficiency is suspected, samples of typical leaves should be shown to an expert so they can advise on the appropriate fertiliser to apply.

Nitrogen deficiency

Cause

This is not usually a problem as atmospheric nitrogen and nitrogen fixed by legumes maintain soil nitrogen levels. This deficiency can occur when woody material such as bark chippings are added to the soil. Soil organisms will utilise any nitrogen in order to break down this material, thus making it temporarily unavailable to growing plants. This is more likely to be a problem on light soils and those with a low organic matter content.

Symptoms

A pale greenish colour of the leaves, which turn yellowish in extreme cases. This is seen first on the older foliage (which is often smaller than usual). Growth may be poor or stunted and flowering and fruiting delayed. Fruits will be small and highly coloured.

Remedy

This shortage may be corrected by applying a nitrogen-containing fertiliser during the growing season, or a composted mulch such as well-rotted farmyard manure, and in the longer term by building up levels of organic matter in the soil. Foliar sprays can also be applied.

Phosphorus deficiency

Cause

This is primarily caused by leaching and is therefore most common in areas of high rainfall, especially on poor soils.

Symptoms

These include poor growth and the foliage turning a dull blue-green or purplish colour (not

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yellow). Older leaves are affected first. Fruits are small and acid tasting.

Remedy

Apply organic sources of phosphorus such as rock phosphate or superphosphate fertiliser.

Potassium deficiency

Cause

Most common on light, sandy soils and chalky or peaty soils with a low clay content. It is also found on heavy clays with a poor structure.

Symptoms

This deficiency is indicated by the edges of the leaves curling up and going brown as if scorched, with brown patches on the undersides, and yellowing of leaf veins. Purple spots may also appear on the leaf undersides.

Remedy

This can be remedied by applying bonfire ash, seaweed meal, composted bracken, comfrey liquid or other organic potassium-rich fertilisers. An excess of potash, however, can upset the balance so that fruit is produced at the expense of young growth. In the longer term the soil structure should be improved by adding plenty of well-rotted compost or manure. Wood ash has a high potassium content but should be composted first, as it is in a highly soluble form.

Manganese deficiency

Cause

This is sometimes a problem on poorly drained soils with a high organic content. Manganese may be unavailable to plants where pH is high.

Symptoms

Shown by a yellowing between the veins of older leaves. Brown spots may also appear on leaf surfaces and younger leaves may be rolled upwards. Severely affected leaves turn brown and wither.

Remedy

This can be remedied by improving soil structure and drainage.

Diseases

Trees may be affected by various diseases that reduce yield and damage or even kill the tree. Regular inspection of the orchard is important to identify the infection at an early stage.

The most common diseases of fruit trees such as scab, fireblight, silver leaf, bacterial canker of cherries and cobnuts, and canker of apple and pear, can be controlled effectively by pruning and removal of affected branches and leaves at the first signs of infection. All infected material should be removed and burnt.

Also check the perimeter hedges and trees for these diseases. Potential problems can be reduced by growing a mixture of varieties and planting those that are adapted to local conditions or naturally disease-resistant.

Creating good site conditions is important. Well spaced trees pruned to allow plenty of air and light in are much less likely to suffer from disease and infection. A combination of regular mulching, watering and weeding prevents young trees from becoming stressed, when they are more vulnerable to disease.

Pruning in the right conditions (ie avoiding wet and frosty weather, and only pruning stone fruits in summer) will help reduce the chances of infection.

Bacterial canker (*Pseudomonas syringae* pv. *morsprunorum* and *P. syringae* pv. *syringe*)

Cause

A bacterial disease of *Prunus* species (stone fruits) most common on cherries and plums, but also affecting apricots, peaches and ornamental *Prunus* species. The disease weakens the plant and can cause extensive die back if not treated. Plants growing in poorly drained soil are more susceptible to this disease.

The disease infects the leaves in summer, gaining entry through stomata. During autumn, the disease can enter the scars left by the falling leaves. It will also enter the bark through any natural bark openings, injuries or wounds made during pruning. These give rise to small cankers in which the bacteria survive the winter.

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'Victoria' plum and 'Laxtons' gage are particular susceptible to bacterial canker.

Symptoms

The earliest symptoms are brown spots, often ringed with a yellow halo, that appear on the leaves in summer. These dry and turn into holes, and cause premature leaf fall. Shallow hollows that exude gum may also appear on the branches. The main other symptom is cankers. These may appear on twigs, branches and the trunk. Inside the cankered areas, bark becomes darker, looks wet and shrivels. These can kill the branch completely, causing the tree to die back. They can kill the tree if they completely girdle the stem.

Remedy

There is no positive remedy, apart from pruning off affected growth. Trees often recover and become immune. Pruning should be carried out as for Silver leaf (see below), and tools should be wiped with disinfectant between each cut. Spraying trees during autumn with a fungicide may reduce the chances of infection.

Certain rootstocks such as Myrobalan plum rootstocks and F12/1 cherry rootstocks may convey some resistance to bacterial canker.

Bitter pit

Cause

Affecting apples, this is not a disease but a calcium deficiency, brought on by a lack of water causing poor calcium uptake and distribution within the tree to the growing tips of the tree and fruit. It may be due to a particularly dry year or to the bad positioning of the tree. Excessive fertiliser applications can also exacerbate the problem by stimulating excessive growth which then deprives the fruit of calcium.

Large fruits on young or vigorous trees are most prone to this disorder. Some cultivars are more susceptible than others; some are rarely affected. Susceptible cultivars include: 'Newton Wonder', 'Merton Worcester', 'Egremont Russet' and 'Bramley's Seedling'.

Symptoms

Sunken pits or depressions develop on the surface of the fruit, with discoloured soft brown flesh immediately below.

These may give the fruit an unpleasant, bitter flavour. Bitter pit can appear late in the season and also in storage.

Remedy

Keep trees well mulched to retain moisture and maintain a regular water supply during dry weather. Removing any excessive new growth such as water shoots through the summer can be beneficial, as this leaves more calcium for the fruit and reduces water loss through the leaves.

If bitter pit is a persistent problem it can be remedied using foliar sprays of calcium nitrate fertiliser, from mid-June to mid-September or by adding calcium in the form of agricultural lime.

Blossom wilt (*Sclerotinia*)

Cause

Caused by a fungus which infects the young shoots and flowers in the spring. The fungus overwinters in bark of twigs affected from the previous year's growth. It is most common on ornamental flowering cherries, but can affect plums, pears and apples.

Symptoms

The shoots and flowers die, wither and hang in the crown, the withered flowers smelling distinctly sweet. Numerous tiny, buff-coloured pustules cover infected areas. The disease can resemble frost damage and fireblight, however fireblight does not affect stone fruits.

Remedy

Prune and remove infected material. Orchards should be inspected once every three to four weeks after petal fall. If infection is detected the infected wood should be pruned out and burnt.

Brown rot

Cause

Caused by a fungus, this affects the fruit of apples, pears and plums.

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Symptoms

The fruit first develops brown areas of soft decaying flesh which quickly envelop the whole fruit, followed by concentric rings of yellowish white mould. Fruit that remains on the tree shrivels up and persists through the winter.

Remedy

All rotting fruits should be removed from the tree and destroyed, including mummified fruits.

Canker

Cause

Not the same as bacterial canker, this affects the majority of fruit trees, but most often apples and pears. It is caused by wind-borne fungus invading natural openings or scars left by fallen leaf stalks and pruning. It is often problematic on heavy and poorly drained soils.

Symptoms

Sunken lesions and fissures appear on branches or main stems, surrounded by cracked or corky, brown, flaky bark. Branches may swell up around the infected area. Canker can also be identified by its fruiting bodies which appear as tiny white dots in summer, and red dots in autumn. If left unchecked it will cause misshapen growth, eventually girdling branches and causing die-back. If it surrounds the stem the branch will die.

Remedy

The only effective way of removing canker is by cutting out affected material to clean wood and burning all infected branches. Affected larger branches can have affected wood scraped away with a sharp knife, removing all parings. Spraying with a systemic fungicide may also help. If canker has reached the main trunk then it may be necessary to remove the whole tree.

Fireblight (*Erwinia amylovora*)

See also Defra information note details available below.

Cause

This bacterial disease affects apples, quinces and related trees, particularly pears. While hawthorn in hedges is good for attracting pollinating insects it may also harbour fireblight.

Hawthorn has been a major cause of spread through the country. Indigenous to North America, fireblight was first recorded in the UK in Kent in 1957 and is now widespread in south and central England, with scattered occurrences in northern counties.

Fireblight is easily spread from one plant to another by rain splashes, birds, bees and other pollen and nectar gathering insects, and by an infected plant rubbing against its neighbour.

Infection usually occurs in spring through lenticils or wounds in young shoots, or through blossom. Injured tissue, for instance from hailstorm or insect damage, is highly susceptible to infection. The pathogen spreads through the tree from the point of infection up to the twigs and branches via the vascular system. If unchecked these cankers may eventually spread to and encircle the main stem, killing the tree.

The time of maximum risk of infection is late spring or early summer when the bacteria emerge from their dormant period and the oozing from cankers is most pronounced. Warm and wet weather conditions facilitate this. For this reason late flowering varieties are particularly susceptible. Cankers become dormant in autumn and provide a source of infection again the following spring.

Symptoms

Fireblight gets its name from the burnt appearance of affected blossoms and twigs, but it can affect all aerial parts of the host tree.

Flower clusters wilt and turn brown following blossom infection. Leaves appear to have been scorched or burnt from underneath. Fruits turn brown or black and become shrivelled, but remain attached to the tree. Twigs shrivel and blacken, the ends often curling.

In more advanced cases cankers - sunken, discoloured oozing patches surrounded by irregular cracks in the bark - form on branches. The translucent amber or reddish ooze contains masses of bacteria, which may then be distributed to other parts of the same plant or to different plants, causing secondary infections.

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When the bark is removed, a reddish-brown discolouration of the underlying tissues may be revealed.

Remedy

There are no effective chemical measures available in the UK to control fireblight. The only solution is to remove the affected wood. If infection is detected at any stage its spread can be halted by pruning out affected branches.

Branches under 25 mm in diameter should be cut at least 30 cm below the last signs of infection (red staining); with larger branches this should be 60 cm. Young trees and shrubs are best removed entirely.

Although heavy persistent infections can be fatal, fireblight rarely kills a tree completely and with correct pruning the tree is likely to recover and not be re-infected for many years.

The bacteria are very easily transmitted so all infected material should be burnt. Care should also be taken to disinfect tools. Pruning should be carried out in dry weather, tools should be sterilised between cuts and the diseased material should be removed from the orchard and burnt. The whole orchard and surroundings should be carefully inspected for further signs of infection.

Late-flowering varieties are more susceptible as they flower when relatively large numbers of bacteria are present. Early-flowering cultivars may escape infection in most years.

Planting on resistant rootstocks can help prevent infection. Old Home, an American *Pyrus communis* variety with a degree of fireblight resistance, will confer this to the scion pear variety. 'Pyrodwarf, a semi-vigorous rootstock with Old Home parentage that has a similar vigour to 'Quince A', has been used for bush trees.

Trees become less susceptible to fireblight as they get older; generally trees over 20 years of age are unlikely to be affected. However, even 200 year old trees can succumb to fireblight.

In orchards where fireblight is a problem, trimming hawthorn annually in hedges adjacent

to orchards will reduce the numbers of flowers, which are a major site for fireblight infection. This may also reduce the numbers of pollinating insects visiting the orchard, and reduce the wildlife value of the hedges.

Honey fungus (*Armillaria*)

Cause

Honey fungus is the name given to a common genus of fungi, several species of which are present in the UK. Most species are relatively benign, existing primarily on dead and decaying woody plant material and playing an important role in the recycling of nutrients from dead wood.

However, some are potentially fatal pathogens. *A. mellea* is most likely to attack orchard trees, though it also affects a wide range of trees, shrubs and climbers. Weak and stressed trees are most susceptible, but it can also attack healthy plants.

Honey fungus spreads underground from infected living and dead roots and stumps by direct contact with the roots of neighbouring plants or through the soil by sending out rhizomorphs or 'bootlaces'. These grow relatively close to the soil surface (in the top 20 cm) and spread at the rate of around 1 m a year, invading new roots, or the root collar (where the roots meet the stem) of woody plants.

Infection by spores is also possible. These usually only grow on freshly damaged plant material ie damaged bark or crushed/dying roots.

A. mellea has edible fruiting bodies with long pale yellow stems and a whitish, collar-like ring on the stem, just below the cap. The smooth, honey-coloured caps are 3–15 cm in diameter, with pale scales. They appear in the autumn, forming fan-shaped clusters round the base or roots of infected plants, and dying back after the first frost.

Symptoms

Initial symptoms of honey fungus infection include the discolouration and defoliation of leafy branches or failure of leaves to appear in spring.

The most obvious presence of honey fungus is the thin, paper-like sheets of white or cream

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fungal growth (mycelium) smelling strongly of mushrooms, sandwiched beneath the bark and the underlying wood on the upper roots and lower trunk, occasionally spreading higher.

The reddish-brown to black, root-like rhizomorphs or 'bootlaces' vary in thickness and length. They resemble old roots and form a fine-mesh black netting beneath the bark on the roots. With *A. mellea* these tend to be sparse and hard to find. Roots that have been infected for some time show a soft, mushy, stringy decay.

An infected tree will usually die once the fungus has girdled it, or when extensive root death has occurred. This can happen rapidly or may take several years. Infected trees may exhibit prolific flower or fruit production shortly before death.

Remedy

There is no chemical control available. Completely digging out the dead stumps and roots of infected trees before it can spread is the only way of controlling the spread of honey fungus. Infected materials should be removed immediately and disposed of, ideally by burning. For smaller areas a degree of further control can be achieved by removing the top 60 to 90 cms (2 to 3 feet) of soil and replacing it with infection free soil.

In an orchard situation these methods are likely to be prohibitively expensive and time-consuming. They will also most likely be impractical anyway, as within the orchard the tree's roots and mycorrhizal associations will be interconnected.

Preventing infection by keeping plants healthy and growing strongly is the best method of controlling honey fungus. Mulching young plants regularly will help their establishment. Mature plants are more likely to fight off *Armillaria* infection if they have a strong mycorrhizal association, so regular fertilising of the sward should be avoided. Inoculating the roots of newly planted trees with mycorrhizal powder may also help.

Plum Pocket (*Taphrina pruni*)

Cause

Affecting plums damsons and wild *Prunus* species including *P. spinosa* (blackthorn or sloe) this rare disease is caused by a fungus similar to that which causes peach leaf curl. It has a number of colloquial names, including 'Bent banana disease' and 'bladder plums'.

The disease cycle generally begins in early spring and is favoured by cool wet weather when spores released from infected fruit are spread on air currents or by water splash. Leaves, shoots, and fruit are all susceptible to infection, but symptoms most commonly develop on fruit. The fungus overwinters on the bark in twigs and bud scales and then attacks the young fruitlets again the following spring. New shoots and leaves may be infected as well as fruit.

Symptoms

The most common and obvious symptoms of plum pockets are seen on the fruit. The first signs of infection are small blister-like white spots on the fruitlets three to four weeks after blossom time. These spots enlarge rapidly as the fruit develops. The flesh of the young fruit becomes spongy and develops a white spore layer over the surface as the fruit starts to shrivel. A cavity develops in place of the stone and the infected fruit grows much more quickly than the healthy fruit.

The diseased fruit enlarges rapidly to ten or more times its normal size, becoming elongated, twisted, one-sided and curved like a small banana. Infected fruit develops a spongy texture and white covering over the skin as the fungus spreads. The fruit gradually turns grey, creased and hollow, resembling a pocket, until the only tissue left is a dark dry shell. Eventually it falls off, although some fruit may remain on the tree.

Twig and leaf infections are much less common but exhibit the same type of irregular growth, becoming thickened and twisted.

Remedy

Affected fruit should be removed promptly, preferably before it turns white. Any diseased twigs should be cut out as well.

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Although it causes a reduction in yield this disease rarely affects all the whole crop at once and may not recur for several years, if ever.

Plum pox

See also Defra information note, details available below.

Cause

Also known as sharka, this devastating viral disease of *Prunus* species is caused by the plum pox virus (PPV). The different strains may infect a variety of stone fruit species including peaches, apricots, plums, nectarine, almonds, and sweet and tart cherries and ornamental *Prunus* species.

The virus is transmitted in two main ways. It is spread by aphids from other infected trees or wild hosts such as blackthorn. It is also spread by the transfer of infected plant material to new locations. When a host tree is infected it usually spreads slowly, only affecting one or two branches at first, but eventually spreading through the tree. Plum pox poses no health risk to consumers, but can ruin the marketability of stone fruit by causing acidity and deformities.

Symptoms

The symptoms of plum pox can vary greatly depending on the host species and variety, the locality, the season and the strain of the virus.

Plum leaves develop pale green or light yellow chlorotic spots or rings. Some cultivars may show yellowing line patterns, bands and blotches. These are most clearly visible on fully expanded leaves from late May/early June. Leaf distortion has also been observed.

Plum fruit symptoms vary depending on the original colour of the fruit. Dark-skinned fruits show bluish, necrotic rings which may be sunken, while pale-skinned fruits show uneven ripening, blotching and rings. Some plum and apricot fruit can be severely deformed and bumpy. Necrotic tissue can extend through the flesh to the stone, on which a reddish necrotic ring may develop.

As well as reducing fruit production, the visual symptoms and accompanying reduction in sugar content make affected fruit unmarketable.

The presence of plum pox can also enhance the effects of other endemic viruses infecting various *Prunus* species, such as prune dwarf virus, *Prunus* necrotic (browning) ringspot virus and apple chlorotic (yellowing) leaf spot virus, resulting in still greater economic losses.

Remedy

There is no cure or treatment for the disease once a tree becomes infected. The only way to manage the disease is to destroy all infected trees. Once the disease becomes established, control and prevention measures for plum pox include field surveys, use of certified nursery materials, control of aphids and elimination of infected trees in nurseries and orchards.

Sources of resistance exist in *Prunus*, but are not common. A genetically modified plum pox-resistant plum called C5 has been developed, and the resistance can be transferred through hybridization to other plum trees. Attempts to genetically modify resistance into other *Prunus* species have not yet been successful.

Powdery mildew

Cause

This can affect all fruit trees and is usually caused by drought stress.

Symptoms

A white powdery coating of fungal spores appears on new shoots and leaves. The disease causes stunting of shoots on young trees and the reduction of flowers and spurs on older trees.

Remedy

Mildewed twigs should be removed in spring and any weeds that may compete for moisture cleared from around the base if the tree is young. Thinning the tree to create a more open structure to the tree will help reduce any reoccurrence. An organic mulch applied around the base of young fruit trees can help maintain moisture.

Replant disease

Cause

Replant Disease is caused by soil fungi attacking the plant roots.

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It can occur when a young tree is planted in soil formerly occupied by an older tree, particularly one of the same species, whose roots have been growing there for some years. This can leave the soil impoverished and possibly infected. More vigorous rootstocks are less susceptible to this. It particularly affects apples.

Symptoms

Severely inhibited growth, which can make the tree more susceptible to other diseases and deficiencies.

Remedy

It is important to plant young trees in fresh ground or at least remove impoverished soil and replace it with top soil from another area which has not grown similar fruit trees. Planting a species unrelated to the previously planted tree can help. The longer it has been since the previous tree occupied the planting, the less of an issue this will be.

Russeting

Cause

Russeting is a brown, corky net-like condition on the skin of apples or pears. It has been associated with specific environmental conditions, in particular moisture from heavy dew or rainfall on the surface of the fruit during its early development and cold temperatures during the late bloom period.

Damage from harsh chemicals, excess nitrogen, or infection by certain fungi, bacterial and viral organisms have also been linked to russeting. The fruit of younger or vigorously growing trees seem more prone to russeting than older and slower-growing trees.

Although in some varieties it can affect the saleability, russeting only affects the skin and does not spoil flavour or storage; it is often thought to improve the flavour.

Symptoms

A tan-coloured, corky tissue, usually greenish brown or yellowish brown in colour. It may appear on only a small portion of each fruit, or may cover its surface. In severe cases, especially where russeting occurs early in the season, the skin becomes thin and tight and

can't stretch with the developing fruit, and may crack. These cracks into the flesh allow fungi and bacteria to enter and rot the fruit.

Many apple and pear varieties may display some amount of russeting, some are more prone than others. Some varieties characteristically display a large amount of russeting where it is not considered a defect, eg 'Egremont Russet'.

Remedy

A range of sprays including copper sprays have been used to reduce russeting, but as russeting is usually only cosmetic this is not normally considered necessary. If the trees are watered, watering in the evening and avoiding high temperatures will help reduce russeting.

Scab

Cause

Scab is a fungal disease of apples, pears and sometimes peach trees. It is particularly a problem in areas of high rainfall and humidity or where the soil is heavy or badly drained.

Symptoms

Scab can affect both the leaves and fruit. The leaves become puckered and develop dark, rounded, dusty blotches and fall prematurely. Young shoots can also develop pimples like blisters which turn to cracks and scabs. The fruits develop brown or blackish corky scabs, cracks and blisters on the skin. These are usually only skin-deep and do not affect the yield or flavour. Affected fruit may rack or split though, making it vulnerable to other infection.

Remedy

Scab is commonest after a wet spring and is passed on by fallen fruit and leaves so these should be collected up and burnt during the autumn to destroy the over-wintering stages of the fungus. A limited amount of control can be gained by pruning out obvious overwintered infections. Some varieties are especially susceptible, notably Cox's Orange Pippin.

Silver leaf fungus (*Chondrostereum purpureum*)

Cause

This is a fungus that is active in the living sapwood (rather than the dead heartwood) of trees. Silver leaf can affect a wide range of fruit and ornamental tree species, including most species of the rose family *Rosaceae*, particularly the genus *Prunus*.

In the UK it is usually only affects plums and, to a lesser extent, damsons and cherries. 'Victoria' plum is particularly susceptible to infection. Plum cultivars that show some resistance include: 'Black Prince', 'Blaisdon Red', 'Jefferson', 'Marjorie's Seedling', 'Merton Gem', 'Monarch', 'Pershore Yellow Egg', 'Purple Pershore'. 'River's Early Prolific' is particularly resistant.

Fruiting fungal brackets form on dead, previously infected branches during autumn. Spores released from these are carried in the air, infecting new trees by entering living tissue through fresh wounds caused by pruning, rubbing or other damage. They produce fungal threads which grow through the living wood, producing toxins in the sap and killing the tissues. Large wounds (>50 mm diameter) are more susceptible to silver leaf infection, due to a reduction in the inhibitory influence of the cambial layer and their greater surface area.

Rainfall and humidity determine the number of spores released from the fruit bodies. Large numbers of spores are released on days when it is raining, foggy or calm and there is high humidity. Spore numbers drop rapidly on sunny days with low humidity and strong winds. Temperature also has an important influence on the numbers of spores released; this peaks at around 18 deg C and then declines rapidly above 20 deg C.

The life cycle of the silver leaf fungus is particularly adapted to infect trees during winter. Rainfall and relative humidity are higher than at other times of the year, the reduced evaporation enabling fruit bodies to remain hydrated longer. Host trees are dormant and more susceptible to infection, and conditions are more likely to be suitable for germination.

By late spring/summer the aging fruit bodies produce fewer spores and the weather is less favourable for sustained spore production.

Symptoms

The leaves develop a silvery sheen, caused by air in the tissues. The foliage and shoots then discolour and wither, dying off progressively as the disease works back along the branch.

As infected branches thicken they develop a purplish stain in the centre which can be seen when cut across. Sometimes the tree may bear flat, small, purple or brown fungal bracket growths with a wavy margin and a whitish woolly upper surface, produced on dead, previously infected wood. Other symptoms can include reduced leaf area, reduced root growth and smaller and fewer fruit.

Remedy

Silver leaf is incurable, but trees with only mild infections may recover from it. Diseased wood should be pruned away, cutting back to a point 10-15 cm after an unstained cross-section is reached. The further back into a tree the fungus has spread the less chance the tree has of recovering. If Silver Leaf has gone unnoticed until it has reached the main trunk then it may be necessary to remove the tree completely. The roots can either be removed or covered with soil to prevent the fruiting bodies developing.

As silver leaf only spreads from spores produced by the fruiting bodies there is no chance of infection from the silvered leaves and transfer by secateurs, pruning shears and root grafts is not significant. Similarly, trees and branches killed by silver leaf do not carry infective material themselves.

They may develop fruiting fungal brackets at a later date however, and for this reason may be removed from the orchard and burnt. Spores are windborne and can travel considerable distances. The risks of infection can be reduced but not eliminated by the removal of dead infected trees. As the spores only affect live wood, fallen and standing dead wood that has not been killed by silverleaf cannot subsequently become infected, and can therefore be safely left in the orchard.

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Regular maintenance pruning, maintaining an open structure and removing damaged wood, will minimise the chances of infection occurring. Pruning should be confined to small branches where possible.

Pruning should be carried out in the summer between May and early September, when there are fewer fungal spores present in the air and the tree is actively growing. This allows the rising sap to 'flush out' the wound which will also heal more quickly, minimising the risk of pathogens entering and causing disease. To minimise the likelihood of wound infection, pruning should be undertaken on warm, sunny days when relative humidity is below 70% and there has been no rainfall for 24 hours. Strong, drying winds during pruning are a bonus. As a general rule, do not prune on days that are not suitable for hanging washing out to dry!

Isolates of the fungi *Trichoderma viride*, sold as Binab T, have been used as a biological control for silver leaf in fruit trees and ornamental trees.

Pests

Defoliation is often a sign of insect pests. These may include aphids or winter feeding caterpillars. Codling moths, whose caterpillars can cause maggoty apples, are a common pest. In a traditional orchard most pests will be controlled by predators before they reach unacceptable levels. Where necessary many pests can be controlled using biological or organic methods.

Chemical pest and disease control

Traditional orchards managed without pesticides provide the richest wildlife habitat. Using any insecticide, herbicide or fungicide, whether modern or traditional (such as sulphur washes) will be detrimental to wildlife. Their use will alter the natural balance of habitats and species present, often removing beneficial predators as well as pests and leading to the need for further spraying. Therefore, pesticides should be used sparingly or preferably not at all. Broad-spectrum sprays should be avoided as they also eliminate beneficial predatory and pollinating insects.

Orchard management aimed at maximum wildlife conservation will inevitably affect fruit production to some degree, but it is possible to

strike a balance between the two. Where commercial considerations make the use of pesticides necessary, targeted use of specific pesticides can still allow orchards to support a diverse range of wildlife by restricting the impacts on natural predators

Organic production and biological pest and disease control

Modern intensive bush orchards receive, on average, eighteen spray applications each year. However, fruit can be grown without the use of chemicals if a certain amount of interference from pests and diseases and the odd blemished skin can be tolerated. Organic control depends largely on prevention rather than cure. Potential problems can be reduced by planting a mixture of varieties that are adapted to local conditions or are naturally pest and disease resistant.

Instead of resorting to chemicals, birds and natural invertebrate predators such as predatory bugs, lacewings, ground beetles, ladybirds, hoverflies, midges, parasitic flies and wasps, predatory mites (such as *Typhlodromus pyri*), spiders and soil living nematodes can be encouraged. Maintaining these and other 'neutral' invertebrate species, which are neither directly harmful nor beneficial, will provide alternative food for predators and will contribute to the increased diversity of invertebrates and vertebrates.

Providing suitable habitat will encourage natural predators, for example allowing areas of tall herb vegetation and nectar-rich flowers to develop will provide food and overwinter cover.

Ladybird and lacewing 'nest boxes' in which insects overwinter can be put in the trees. Mosses and lichens left undisturbed on trees provide ideal habitat and protection for insects. Birds can be encouraged by additional feeding and, if there are no mature trees with suitable nesting sites, provided with bird boxes.

Biological pest controls such as pheromone traps can be used in spring from late May onwards to control pest species such as codling moth on apples and plum moth. Such traps use specific chemical pheromones to lure in and trap male moths, preventing them mating with the females.

Traditional orchards: fruit tree health

It may also be possible to apply sprays containing naturally occurring diseases and parasites specific to a range of pests.

If time allows, one of the best ways to control pests such as aphids, particularly on young trees, is to remove or rub them off by hand.

Grease bands can be placed round the trunks of the trees to prevent winter moths and other insects climbing up into them to overwinter or to feed in the spring. Codling moths can be controlled by tying cardboard or sacking around the trunk in the summer when the caterpillars are looking for somewhere to pupate; in the winter these materials can be removed and destroyed.

Grey squirrels are a severe pest in cobnut plots. Where trees have a clear stem, baffles may prevent squirrels from accessing the tree.

Harvesting

Picking fruit

Fruit should generally only be picked when it is ripe, when it can be removed from the tree by placing a cupped hand under the fruit, lifting and gently twisting. Pears should be harvested when still firm.

Fruit should be handled gently and inspected individually for pests, disease and damage, and given a quick clean with a cloth.

Slight insect damage (or scab or russetting on apples) on the skin is harmless, but any bruised blemished, imperfect fruits fruit should be discarded or prepared for cooking straight away, as it will rot in store and infect the rest of the crop.

Preparing fruit for storage

Fruit can be stored loose in containers, trays or boxes, which allow enough space for air to circulate around the fruit, standing them so they are not quite touching each other on newspaper and putting rolls of paper between the rows.

Stackable crates, slatted wooden shelves or wooden orchard boxes are ideal for this. Polystyrene trays which have compartments to hold each apple separately may also be used.

Many companies sell bespoke fruit storage containers for different types of fruit. Each tray should be labelled with the name of the variety and season for eating.

Apples will store better if individually wrapped in tissue paper or newspaper. Alternatively they can be packaged together in pierced or perforated plastic bags and refrigerated. Pears should be stored individually, rather than wrapped or placed in bags. Quince have a pungent aroma and should not be stored near other fruit.

Storing fruit

The stored fruit should be kept in a cool, dark, draught-free but well ventilated, frost-free environment with a moist (but not damp) atmosphere. A cellar, garage or garden shed is ideal. Aim for a constant temperature, of about 5-8°C, ensuring that temperatures do not fall below 3°C. Alternatively fruit can be kept in a fridge or cooked and frozen.

Apples that ripen at different times should be stored separately, as the gases given off by earlier varieties will shorten the storage life of later ones. Early season apples don't store well, and some early ripening varieties of apple such as "Discovery" and "Ellison's Orange" have to be eaten straight from the tree. Mid season varieties can store for up to five weeks. Late season varieties finish ripening many weeks after they have been picked. They may keep till March or longer and some may require storing for several months to fully develop their flavour.

Pears generally go off quicker than apples and most varieties will not store beyond Christmas. They need to finish off the ripening process before eating by moving them into a warm area a week before eating to ripen them up.

Fruit should be inspected regularly for signs of rot or decay and for damage from rodents and insects. Remove any fruit which shows signs of deterioration. Fruit should be handled carefully to prevent any bruising, which can leading to rot.

Problems

If fruit starts to rot, it may be because it has been damaged, or due to inadequate ventilation.

Traditional orchards: fruit tree health

Shrivelling fruit may be caused by the temperature being too high or the atmosphere lacking humidity. Storing the fruit in polythene bags or damping down the floor occasionally will help maintain a sufficiently moist atmosphere.

Further information

Natural England Technical Information Notes are available to download from the Natural England website: www.naturalengland.org.uk.

This note is aimed at managers of traditional orchards and agri-environment scheme land management advisers. Other related notes:

- TIN012 *Traditional orchards: a summary*
- TIN013 *Traditional orchards: site and tree selection*
- TIN014 *Traditional orchards: planting and establishing fruit trees*
- TIN015 *Traditional orchards: an introduction to pruning*
- TIN016 *Traditional orchards: formative pruning of young trees*
- TIN017 *Traditional orchards: maintenance pruning*
- TIN018 *Traditional orchards: restoration and management of mature and neglected orchards*

- TIN020 *Traditional orchards: orchards and wildlife*
- TIN021 *Traditional orchards: glossary*

For further information contact the Natural England Enquiry Service on 0300 060 0863 or e-mail enquiries@naturalengland.org.uk.

Defra information notes

- *Fireblight*
www.fera.defra.gov.uk/plants/publications/documents/factsheets/fireblight.pdf
- *Plum pox virus*
www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/documents/protocols/plumpoxvirus.pdf

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