Traditional orchards: planting and establishing fruit trees

Traditional orchards and the trees within them may be hundreds of years old. Mature trees are important for a wide range of wildlife, particularly those birds, mammals and insects that use deadwood. Often all the trees in an orchard were planted at the same time. This means that as the original trees die there are no younger trees maturing to replace them. A mixed age structure of trees is important to maintain habitat continuity. This can be done by planting new trees within an existing orchard or by creating a new orchard nearby. This information note provides guidance on when and how to plant fruit trees and on their management in the first few years after planting. Other notes on traditional orchards are listed below. For an explanation of terms used in this leaflet see TIN021 *Orchard glossary*.

Key points

- New trees should be planted at traditional spacings. Within existing orchards these should follow and reinforce the original planting pattern.
- The correct planting of a tree is crucial to its long-term survival. Take care when planting and do it at the right time of year.
- Trees should be provided with adequate guards to protect them from animal damage.
- Weeds should be controlled to prevent competition until the trees are established.
- Good tree management and aftercare in the first few years after planting is crucial to ensure their survival and long term health.

Pre-planting

Marking out should be done carefully as trees cannot easily be moved once they are planted! Where an orchard is sited on a slope, the planting pattern may need adjusting to take account of the contours.

In an existing orchard it is preferable to plant new trees at the original stocking density, following the original pattern.

However, a tree should not be replanted in exactly the same position as the tree it has replaced unless more than 10-20 years has elapsed since the original tree was removed. This is because the roots of the original tree will have left the ground impoverished and possibly infected with replant disease.

To retain the original planting pattern new trees can be planted to one side of the original tree (1 m away should be sufficient) keeping to the same side in each row. If this is not possible the old stump can be removed and fresh soil added. This will help prevent disease and improve the soil.

Planting stone fruits where apple/pear trees were and vice versa may also help prevent replant disease.

Traditionally orchard trees are planted in straight rows on a set (usually square, quincunx or hexagonal) pattern. This is so each tree receives equal amounts of light and to allow easier access for mowing, weed control and fruit collection.

Second edition 19 October 2010

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Planting pattern

Square

The simplest orchard pattern is the square where the distance between rows is the same as the distance between each tree, the four adjacent plants of two rows forming a square. A slight modification of this is the rectangular pattern, where larger gaps are left between rows than within rows to improve access for machinery.

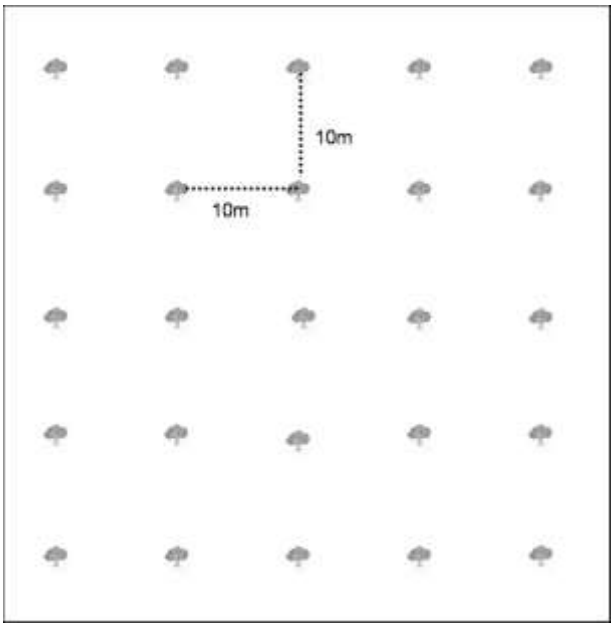

Figure 1 square planting pattern

The advantage of the square or rectangle is that it is easy to lay out and allows machinery to be run across and up through the orchard. The disadvantage is the 'dead' space in the centre of each square. In widely spaced orchards this distance can represent a large amount of the total orchard area, at least until the trees mature.

Quincunx

Another pattern is the quincunx, which is an arrangement of five units in the same pattern as the five spots on die or domino. This pattern is similar to the square system but with an additional tree in the centre of each planted 'square'.

The central tree may be a short-lived temporary tree on a dwarfing rootstock, planted to yield some crop before the permanent trees begin bearing.

These filler trees can then be removed to leave a square planting pattern as the permanent trees mature and the orchard becomes crowded. The disadvantage is that the fillers can make cross cultivation and grazing difficult until they are removed.

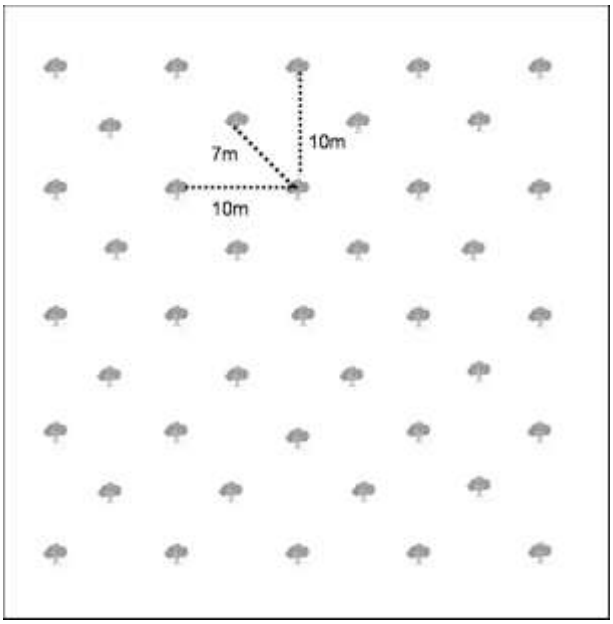

Figure 2 quincunx planting pattern

The quincunx pattern can also be applied to a rectangular system with the centrally planted trees being permanent ones. This effectively forms a hexagonal system (see below) but with wider spacings between the rows in one direction. The benefit is that it allows better access for machinery.

Hexagonal

The triangular or hexagonal system is based on equilateral triangles.

Six adjacent plants form a hexagon with a seventh plant in the centre. The trees are equi-distant in all directions.

This pattern allows the maximum density of trees to be planted, approximately 15% more trees per unit area than the square system.

It also allows agricultural operations to be done in three directions.

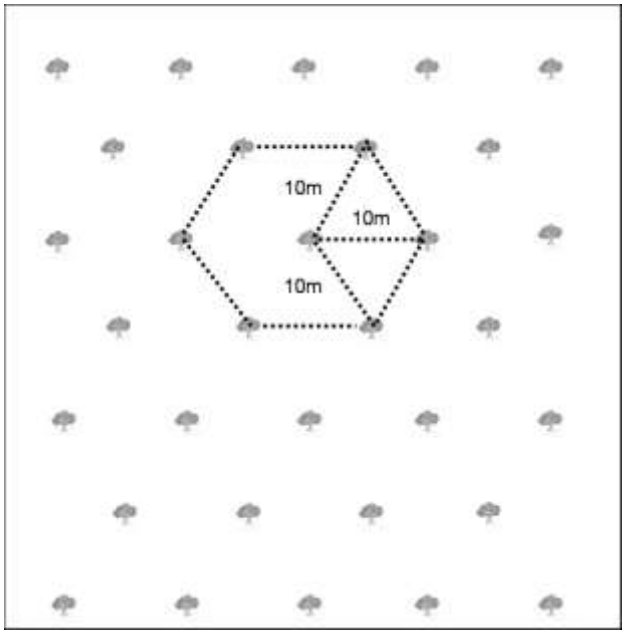

Figure 3 hexagonal planting pattern

Planting density

This depends on the species of tree and also the rootstock.

- Traditional standard dessert and cider apple orchards usually have a planting density of between 100-150 trees per ha with 8-10 m between rows and 7-9 m between trees within the rows.
- Dessert and perry pear spacings vary greatly according to the variety planted, usually planted at between 10-20 m apart, at a density of between 25-100 per ha.
- Cherry trees should be planted 10-15 m apart, between 50-100 per ha.
- Plum trees should be planted about 6-8 m apart, although 8-10 m may be left between rows to facilitate access, between 150-260 per ha.
- Cobnut trees require a 5x5 metre spacing, or about 400 trees per ha.

On poor soils or with slow growing cultivars, trees can be planted slightly closer together. Other factors such as the shape of the area to be planted, tall hedges and ponds will also affect the planting density.

Pollination requirements

Orchards trees (apart from cobnuts) are insect pollinated and usually require pollen from another variety to set fruit (see TIN013 *Traditional orchards: site and tree selection*). Therefore the arrangement of varieties within the orchard and the planting of specific pollinators needs careful thought.

At least two or three different, but compatible, varieties need to be planted to ensure pollination. If single varieties are planted in blocks these should be no wider than six to eight rows apart depending on spacing.

Alternatively specific pollinator trees should be positioned at every fifth tree on every fifth row. In a small orchard with a range of varieties this will not be so much of an issue, particularly if there are other orchards nearby.

Time of year for planting

Bare-rooted fruit trees should be planted from November to March before they come into leaf. Container trees can be planted all year round but require regular and heavy watering if planted during the summer. Planting should be avoided during droughts, hard frosts (most likely in January and February) or particularly cold, windy periods.

Generally it is best to plant in late autumn/early winter while the soil still has some warmth. This allows the tree to become established before spring. In wet areas early spring planting may be preferable to minimise the risk of compaction, waterlogging and uprooting in winter-gales.

Storing the tree

Once acquired trees should be kept in a shady place out of sunlight and frost. If they can't be planted straight away, the roots should be watered thoroughly and wrapped with a plastic sheet to prevent them drying out. The fine root fibres must be kept moist at all times as bare roots can be killed by even a few minutes of exposure to air.

If trees need to be stored for longer than a couple of days they should be heeled into a

trench, where they can be safely left through the dormant period. If the tree roots are dry they should be pruned by a third and stood in a bucket of water for 15 minutes before planting.

Preparing the ground

Avoid planting in heavily shaded or boggy areas. All grass and weeds should be removed in a 1 m diameter circle around each tree station prior to planting, either by physical stripping or spraying with a suitable non-residual herbicide.

Planting

Planting larger trees

Pit planting is preferable if planting big trees with larger root systems or if the soil is poor. (Figure 4).

The hole should be no more than 50 cm deep and just wide enough to accommodate the roots without bending them. It can be dug mechanically but back-filling should be done by hand to avoid root damage. The hole should be dug as soon before planting as possible and covered, if necessary, to prevent it filling with water. If this does happen the hole must be allowed to drain thoroughly and the bottom dug over before planting.

The removed soil should be put in separate piles, one for the turf, one for the topsoil and one for any subsoil. Removing large stones and breaking up the bottom and sides of the pit will allow better drainage and root penetration.

A stake should be driven vertically into the bottom of the hole before planting so the tree's roots can be arranged around it. To prevent stake and tree rubbing, the stake should be put on the upwind (usually the south-west) side of the tree so the prevailing wind blows the tree away from it. The stake should extend 30 cm above ground level and allow for the stem of the tree to be about 10-15 cm away from it. Some topsoil (not the removed turf) should be placed in the bottom of the hole to bed the roots on.

The tree should be placed in the hole so the root collar (the original soil mark on the trunk) is level with the top of the hole.

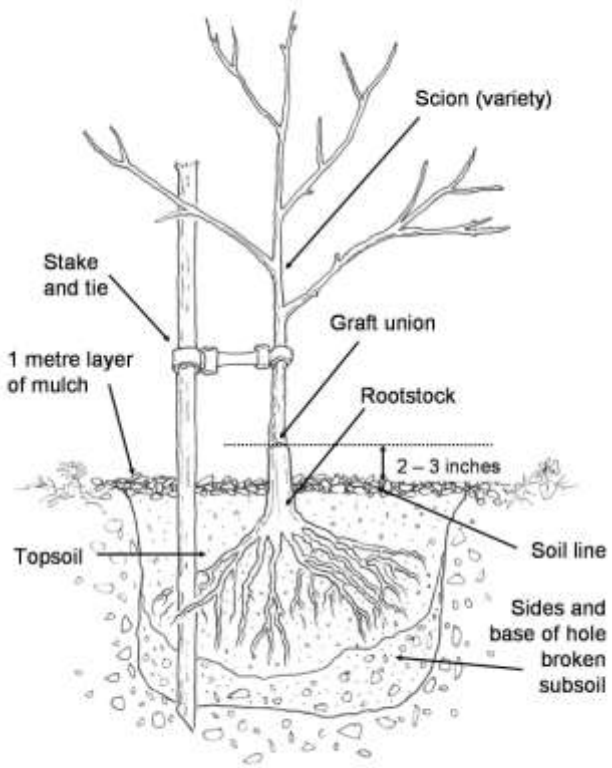

Figure 4 planting big tree

The tree should be rotated to obtain the best fit ensuring the roots are spread out, at the correct depth and the tips not pointing upwards.

Damaged or excessively long roots should be trimmed to fit the hole rather than twirled round the sides. The hole can then be backfilled with the remaining soil, whilst shaking the tree gently and ensuring it stays vertical.

Organic matter should not be added as this can damage soil structure and create drainage sumps. Slow-release fertiliser should only be added to the topsoil on very poor soils as over-fertilising discourages the roots from spreading beyond the planting pit into the surrounding soil. It may also prevent the young trees establishing a relationship with beneficial mycorrhizal fungi in the soil.

If the site is on recently cultivated or fertilised ground some leaf mould or soil from land unaffected by agri-chemicals should be added to the planting pit to ensure the tree is inoculated with mycorrhizal fungi. Mycorrhizal powder can also be used, which should be sprinkled on and immediately around the roots.

The soil needs to be gently firmed in as it is added, to remove any air pockets and firmly anchor the roots, taking care not to compact it. Overfilling the hole by 3-6 cm will allow for the soil compressing and settling slightly, so the final soil level in the hole is not below the surrounding ground level.

The final soil level should be at the root collar. Shallow planted trees may dry out or be loosened by the wind while those planted too deeply may rot.

To avoid disease and prevent the scion from rooting the grafting union should be kept a minimum of 75 mm above ground level and clear of any mulching material.

Planting small trees

These are known as maidens and whips. If the soil has a suitable structure and small bare-rooted trees are being planted the soil disturbance can be restricted to relieving compaction and removing large stones. It should be sufficient to cut a 'T' or 'X'-shaped notch into the ground with a spade, insert the tree and then firm the soil back around the roots.

Planting container trees

Like larger trees these should be pit planted. They also need to be well watered before planting. This is best achieved by submersing the pot in a bucket of water for 10-15 minutes. Any roots circling the pot need to be teased out and spread out into the hole.

Staking

Maidens can be established successfully without staking but standards and half standards require a low stake. This protects the root collar and grafting union from excessive shaking until the root system becomes established.

A low stake, no more than 30 cm high, allows the whole tree to sway in the wind. This stimulates the entire stem to thicken from the root collar upwards and encourages the roots to spread out and anchor the tree. Over time this will create a stout trunk that tapers evenly from base to crown and can flex under the force of wind or vandalism.

Trees staked at the top of the stem just beneath the crown so that the trunk cannot move develop thin, weak stems, which may actually thicken above the tie in response to the crown swaying. Trees with a stem-builder may need a tall stake initially however, to prevent the tree splitting at the higher grafting union.

The stake should be fastened to the tree above the grafting union with a suitably flexible tie that holds the tree firmly upright but allows some movement. If the tie does not have a separate piece to prevent rubbing, it can be passed around the tree to form a 'figure of eight'.

Guards

Most livestock will rub against fruit trees and browse the leaves and twigs .

Horses, sheep and goats will also strip and eat the bark. When creating a new orchard it may be preferable to cut the orchard rather than graze it for the first few years until vulnerable young growth and shoot tips are beyond the reach of stock. However, if trees are adequately protected new orchards can be grazed from the outset. Cutting may not be a viable option when planting within established orchards.

Even if grazing is not introduced young trees may still be damaged by wild animals. Deer may visit orchards if there is woodland nearby and will eat young leaves and shoots. Males may also break the branches of young trees when trying to rub the velvet from their newly developing antlers.

Rabbits and hares can also eat shoots and strip bark. Consequently tree guards are usually necessary from the outset to protect newly planted trees from damage.

Guards can also protect trees from machinery and vandalism and prevent poaching around the base.

Guards should not be fastened to the tree or rub against, constrict or damage it in any way. They should be durable and of the correct height and width to prevent damage. The specification will vary depending on the stock type. Neighbouring stock should be considered if boundary fences are not stock-proof (ie there is little point erecting sheep-proof guards if the neighbouring cattle can get into the orchard).

If the tree threatens to rub against the top of the guard as it moves in the wind, flexible rubber strips or a similar elastic material (bicycle inner tubes or old tights are ideal) can be tied round the top of the trunk and fixed to each side of the top of the stake. These should allow the trunk to move, but not enough to touch the side of the guard. The same method can be used to support trees with a stem-builder. Alternatively, on narrow guards a strip of rubber tubing can be fastened around the top edge of the guard.

Guards should allow access to the tree to carry out formative pruning, apply mulch or clear vegetation around the base. Depending on the type of guard it may be possible to allow access by attaching one side of the netting or barbed wire using hooks rather than nailing down, so that it can be unfastened when necessary.

Cattle-proof guards

These should have four corner posts 2 m high or more with 5 cm diameter top and middle rails. A third rail at the bottom is also preferable, to prevent stock getting underneath the guard. The posts should be placed far enough apart to protect a minimum of 1 m radius around the trunk at the top. The posts should be driven firmly into the ground to keep the guards stable and may be canted slightly outwards, to allow stock to graze closer to the base of the tree.

Alternatively the bottom rail can be raised far enough above the ground to allow stock to graze underneath it. In either instance stock should not be able to reach the stem of the tree.

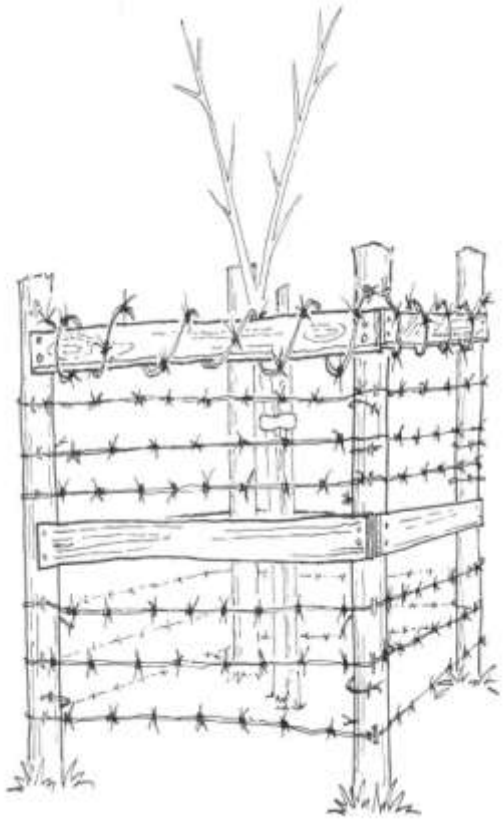

Figure 5 cattle-proof guard

At least three strands of barbed wire should be strung between the middle and top rails, and again between the middle rail and the bottom rail, pulled taut and securely fastened to the corner posts. Barbed wire should also be put along the top rail to stop cattle rubbing against the guard.

Sheep netting can be hung between the middle rail and the bottom rail in place of the barbed wire so that sheep can also graze the orchard.

Weld mesh guards (see figure 7 below) are not strong enough to prevent mature cattle pushing them over if they rub against them. They may be used successfully in orchards grazed with young calves or where there are mature trees present for cattle to rub against. The weld mesh needs to be at least two metres high to prevent browsing damage, which increases the problems with the tree rubbing against the guard. Sheep netting or plain wire may also be substituted for the barbed wire between the top and middle rails if horses graze the orchard.

If so the guards may need to be increased in height and width to prevent the horses damaging the trees.

Sheep-proof guards

Due to the smaller size and weight of sheep these are smaller, cheaper and less robust than cattle-proof guards. However, they limit the choice of grazing animals to sheep. A smaller square or triangular version of the cattle proof guard should be used, without a middle rail and sheep netting should be hung between the rails.

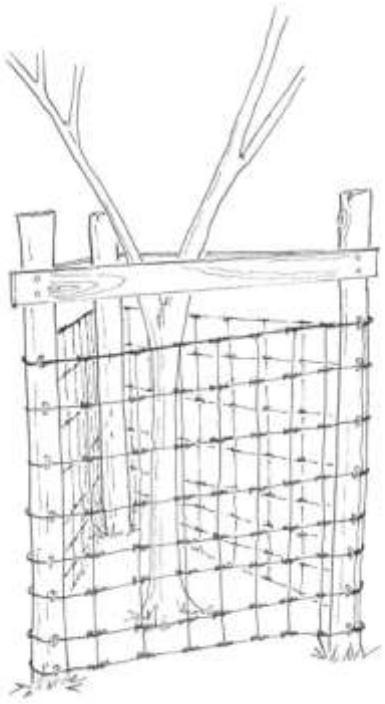

Figure 6 sheep-proof guard

Smaller sheep-proof guard

Alternatively a guard consisting of two stakes placed at least 50 cm apart, may be used. One stake should be at least 1.5 m high, the other should be at least 50 cm high.

Strong weld mesh wire netting at least 1.5 m high should be wrapped around and securely fastened to both stakes in a circle to maintain a distance of at least 25 cm between fencing and trunk. Two strands of barbed wire can be wrapped spirally around the guard to prevent the sheep rubbing against it.

These guards are narrow so there may be issues with the tree rubbing against the top of the wire and damaging itself as it moves in the wind. There are a number of ways to prevent or reduce this.

Figure 7 smaller sheep-proof guard

The weld mesh can be turned round the other way so that the vertical pieces face outward and don't rub the trunk, the top of the weld mesh can be bent outwards so the tree has more room to flex without touching it, or a piece of rubber tubing can be slit lengthways and pushed over the top of the guard to prevent the tree rubbing against the metal. Staking the tree higher up should be avoided as this will reduce the movement to the detriment of strong root development.

Deer

Either style of guard will also be adequate to exclude deer, as long as it is at least 2 m high.

Rabbits and hares

Trees can be protected from these by securely fixing rabbit fencing around the base of the guard or placing a spiral sleeve guard around the tree trunk, ensuring the base is gently bedded into the soil.

Weed control

To reduce competition for water and nutrients while the tree is establishing itself a 1 m diameter circle should be kept clear of all vegetation and maintained for at least the first 3 years after planting. This can be achieved by careful use of an appropriate herbicide (making sure to avoid the trunk), by hoeing (taking care not to damage the roots), by using weed-suppressing membranes or mats, or by mulching.

Mulching (again avoiding the trunk) is preferable. As well as suppressing weeds it helps retain soil moisture, raises soil temperature in the spring and breaks down to provide a slow release of nutrients. Straw, wood chippings or well-rotted farm yard manure can be used. Previously composted mulch is preferable as fresh wood chippings or straw will temporarily lock up nitrogen as they start to decay. This can be alleviated by applying the mulch in the autumn so it begins to break down while the tree is dormant. Mulch should be replenished as necessary maintaining a layer 5 cm deep.

Watering

Newly planted trees require watering when planted and regularly in the first weeks after, with the ground thoroughly wetted to ensure the water reaches the roots. Depending on soil and weather conditions further watering may be necessary during the first few summers. Failure to water may lead to poor growth, smaller and fewer fruit or even the death of the tree.

Ongoing management

The level of care in the first five years after planting is important in helping the tree become established. Most problems with establishing young fruit trees are caused by neglect and lack of management. Regular attention early on will help identify any problems as soon as they arise, when they will be easier to address.

Stakes

While in place the stake should be checked at least every six months and the tie loosened if it starts digging into the tree bark.

By 1-2 years after planting, provided soil and weather conditions have not impeded them, the roots should have grown enough to anchor the tree and the stem strengthened sufficiently for the stake to be removed. If the site has shallow or sandy soil or the tree has developed poorly, the stake may need to be left in place for longer.

To check if a stake is still needed the tie should be released and the tree pushed gently to one side. If it does not return to an upright position the tie should be refastened and the same tried again the next year.

If the tree does return to upright the stake should be removed carefully without being shaken as this may damage the tree roots. The resulting hole should be filled in with soil. Alternatively the stake can be cut off at ground level.

Where stakes have been fastened high up the trunk it may be preferable to refasten the tie lower down the trunk for a year (reducing the height of the stake as well if the tree is likely to rub against the stake) to allow the trunk to flex and prepare the tree gradually for the stake's removal. This will also apply to trees that have been staked above the stem-builder.

Guards

When stock are present guards should be checked as regularly as possible to make sure the animals have not moved them to reach the tree. Trees can be seriously damaged or killed very quickly. Guards should protect the trees from grazing animals for a minimum of 10 years after which it may be safe to remove them.

However, even mature trees can be pushed over, have their lower branches stripped by cattle, or have the bark stripped from the trunk or branches by sheep or horses. They may therefore need long-term protection.

Orchard grassland

Protecting trees from livestock damage

Sheep

It is easier to protect young trees from sheep than it is to protect them from cattle or horses. Mature trees may require protecting from sheep,

as they can strip the bark. This is a particular problem in late winter as the sap begins to rise.

Mature trees may be protected from bark stripping using chicken wire wrapped around the trunk, allowing some overlap. The wire should be fastened in a manner that allows it to be adjusted, to allow for the increasing girth of the tree as it grows. Where there are many trees in an orchard it may be more practical to exclude sheep from mature orchards at this time of year. Alternatively, mineral blocks or supplementary feed can be provided to discourage bark-stripping.

Cattle

Cattle require stronger and more extensive guards. As they can browse at a greater height, they should be introduced to orchards that have traditionally been grazed by sheep with caution, as the lower branches may not have been established high enough to be out of their reach.

Horses

Horse grazing should be avoided if at all possible, as their height and reach makes it extremely hard to prevent them browsing trees. It may be possible to graze them in mature orchards where the branches are high enough, but they may still strip bark. If this is the case the trunk can be protected using chicken wire, similar to that described for sheep, although two widths of chicken wire will be needed.

Pigs and poultry

Pigs (eg Gloucester Old Spots) have sometimes been turned out in orchards, particularly on smallholdings, in autumn to clear up the fallen fruit. This practice should only be carried out with care and keeping pigs in orchards for long periods should be avoided. This is because pigs can churn up the ground as they feed, which damages the sward and fruit tree roots. They can also push over young trees.

Poultry and geese are sometimes grazed in orchards and may be particularly suitable in new orchards with young trees. They not should be allowed where there is any botanical interest in the sward.

Weed control

Once the trees are well established the sward can be allowed to grow up to the trunk, although tall weeds, bramble and ivy should be removed from around the trees. if using strimmers or mowers take care to avoid damaging trees.

Grazing

Traditionally, most orchards would have been grazed to provide food for livestock and to control grass and weeds.

Mature trees also provide shelter for livestock, although this can lead to problems with poaching and compaction.

Stocking densities will depend on the fertility of the site, weather conditions and the stock used to graze it. Generally, the sward should be grazed down to remove each year's growth while leaving a varied, tussocky sward structure.

Where there is any botanical or wildlife interest the grazing should be tailored accordingly (see TIN020 *Traditional orchards: orchards and wildlife*).

Grazing cobnut plats can harm the spring flowering woodland ground flora and nut trees. Traditionally cobnut plats were dug over or hoed annually to get rid of weeds although this practise ceased as labour became more expensive. Any grazing should be limited to autumn and to short sheep, such as Southdowns, to reduce damage to the low-growing trees.

Fertilising

Most existing orchards and new sites will not require fertiliser as they will be fertile enough, both for planting and to maintain average fruit yields. On sites with impoverished soil a mulch of farmyard manure will act as a slow-release fertiliser. These sites are likely to have the greatest diversity of plants in the sward so any applications should be confined to within 1 m of the tree.

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 notes in the series include:

- TIN012 *Traditional orchards: a summary*
- TIN013 *Traditional orchards: site and tree selection*
- 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*
- TIN019 *Traditional orchards: fruit tree health*
- 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**.

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