

Traditional orchards: maintenance pruning

This information note provides guidance on the reasons for the routine pruning of fruit trees and advice on the different methods of achieving this. Maintenance pruning is necessary to maintain the balance between fruit production and vegetative growth. With care, regular pruning to maintain healthy and vigorously cropping trees is possible while still maintaining the wildlife value of the orchard. The timing and amount of pruning required can vary considerably depending on the species, and even variety, of fruit tree. While many complicated pruning techniques have been developed (particularly for apple and pear trees), the regular removal of a few large branches (regulated pruning) is usually sufficient to maintain tree health and vigour.

Background

Why trees require maintenance pruning

After approximately ten years of formative pruning and as the tree matures, the emphasis of pruning shifts away from shaping its vegetative growth and towards fruit production (see *Traditional orchards: formative pruning of young trees*). The degree, method and timing of pruning varies considerably depending on the species and even variety of fruit tree.

A healthy tree needs a balance between mature fruiting wood (to keep generating healthy crops of good quality fruit) and vegetative growth (to rejuvenate the tree and become fruiting wood in the future). Problems can develop when this balance is not maintained.

Maintenance pruning:

- prevents branch rubbing;
- restricts tree size;
- helps form a strong framework of branches;
- allows air and light into the tree;
- induces flower and fruit bud formation; and
- stimulates shoot growth to produce young healthy wood.

What wood to remove

In the absence of pruning, most buds develop as fruit buds and few grow out as shoots.

Therefore, a vigorous tree's growth can be checked by leaving it unpruned or pruning it very lightly for a year. Conversely, the harder a shoot or branch is pruned the more vigorously it will grow back. So hard pruning can stimulate weak growth to produce vigorous, non-fruiting vegetative growth. However, as a consequence less fruit will be produced.

The general rule for maintaining balance is:

- strongly growing shoots (>25 cm annual growth) should be left alone;
- moderately growing shoots (10-25 cm annual growth) should be pruned lightly; and
- poorly growing shoots (<10 cm annual growth) should be pruned hard.

Pruning will vary both in degree and method, depending on the age and variety of the tree. The extent of the pruning will be determined largely by the growth of the tree, but generally it will be much less severe than with formative pruning. The condition of the tree and its performance over the previous years are the best guides for this.

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A balanced pruning regime should aim to remove badly placed, weak, overcrowded and inward-crossing shoots or branches. Pruning will usually be to an outward facing bud to maintain the open structure of the crown. It is best to prune to whatever original style or shape can be seen, bearing in mind the tree's vigour.

Drastically pruning to a new shape can over-stress a mature tree. Most traditional orchard trees were pruned originally to either a standard or half standard open-centred shape (often used for dessert apples and pears), or left with a central leader forming a main trunk (often used for plums, damsons, and cider and perry varieties).

Different species and even varieties of the same species of fruit tree have different forms and growth habits which should be taken into account: pruning will not always follow the same rules for each tree.

Maintenance pruning and biodiversity

The primary aim of regular maintenance pruning is usually to generate a large, high quality fruit crop. Conflicts with wildlife conservation can arise when production is the main management goal, particularly if chemicals are also used. However, if care is taken it should be possible to produce a good crop without significantly reducing the wildlife value of the orchard.

Generally the wildlife value of a tree increases as it matures. Older, larger limbs are more likely to support and develop benign fungi, decaying wood, rot and bird nesting holes (see *Traditional orchards: orchards and wildlife*). Older trees require more care when pruning if their wildlife value is to be preserved (see *Traditional orchards: restoration and management of mature and neglected orchards*).

Forms of fruiting habit (in apple and pear trees)

The basics

Pears and apples have similar fruiting habits and are often pruned to the same growth forms. Although it is not necessary to have a detailed knowledge of this, it is useful to understand the basic principles to be able to prune trees successfully.

During its first year of growth a new shoot or lateral produces axillary buds in the leaf axils along its length. These buds lie dormant over winter and are revealed when the leaves fall off in autumn. Hormones within the tree will then determine the destiny of each bud in the following spring.

During the following growing season (ie the second year of growth) each axillary bud may either:

- remain dormant;
- develop into a growth bud, extending into leafy growth; or
- become a fruit bud, swelling in preparation for flowering the following (third) year.

Growth buds are slim and pointed and lie close to the bark. Fruit buds become markedly fatter than growth buds and often develop downy bud scales.

In the third year fruit buds extend into spurs. At this point the fruit bud usually divides to produce two or more flowers (and subsequently fruit). This process is repeated year after year so that over time these spurs develop into spur systems.

Spur bearers vs. tip bearers

Apple trees are divided into spur-bearing varieties and tip-bearing varieties depending upon where along the laterals the axillary buds develop into fruit buds.

Spur bearers

Most apple and virtually all pear varieties are spur bearers. In the second year of growth the buds on the tips of each lateral extend into new vegetative growth, while the buds at the base develop into fruit buds (Diagram 1). This leads to the spur systems being distributed fairly evenly along the stems and main branches. These will bear fruit for many years.

Some spur-bearing varieties such as Egremont Russet and Lord Lambourne will produce fruit buds on one year old wood, therefore producing flowers and fruit on two-year-old wood.

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Most varieties only produce fruit buds on two-year old wood and older and so only produce fruit on wood that is at least three years old. These varieties can be pruned using the spur pruning and renewal pruning methods (see below).

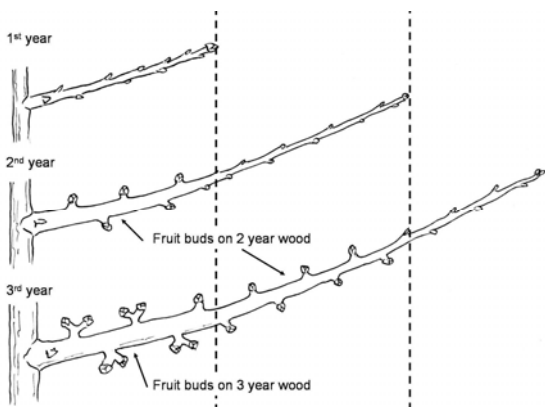


Diagram 1

Tip bearers

Tip bearers are less common than spur bearers but include some popular varieties such as Cornish Gillyflower, Irish Peach, Tydeman's Early Worcester and Worcester Pearmain are all tip bearers. Basically, they grow in the opposite manner. Fruit buds form in clusters at or near the very tip of the shoots, which tend to be longer.

As the tip extends into the second season's new growth, the buds immediately below the 'old' tip on the previous year's growth develop into fruit buds, while the buds at the base of the shoot remain dormant or form vegetative growth (Diagram 2). Because of this, tip-bearing varieties have a gaunt, less compact appearance in comparison to spur-bearers.

Tip bearers should not be spur pruned, as this will remove the wood upon which the fruit forms. They are best pruned using the renewal or regulated pruning methods.

Some spur-bearing varieties are also partial tip bearers, producing fruit buds on the tips of one-year old wood in addition to spurs on older wood. These include Bramley's Seedling, Blenheim Orange, Epicure and Lord Lambourne. These varieties can be pruned using the spur pruning method, but care must be taken not to

remove too many spurs or fruit buds. Tip bearers are unsuitable for restricted forms such as cordons and espaliers, where an even distribution of fruit along the main branches is required.

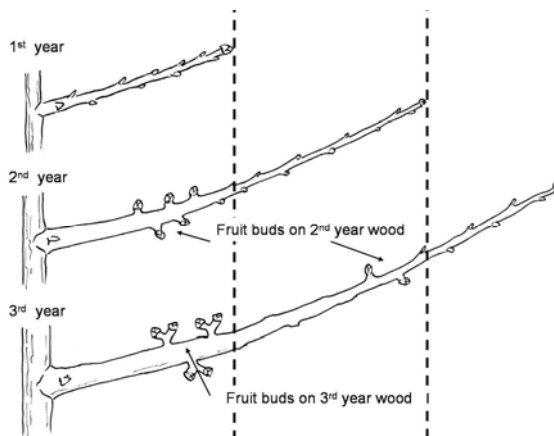


Diagram 2

Methods of pruning standard apple and pear trees

Introduction

Pruning back to a fruit bud will stop a shoot from putting on any more vegetative growth and force it to expend its energy fruiting. Cutting back to a dormant or growth bud will encourage one or more buds to grow out as new shoots. It will also stimulate any fruit buds further back down the stem (Diagram 3).

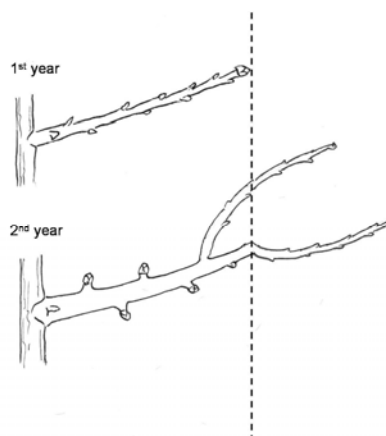


Diagram 3

Taking into account the fruiting habit of the tree, these responses can be manipulated by pruning to control the balance between vegetative and fruit bearing growth. The most important thing to consider when pruning is how the tree is growing

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and fruiting, as well as how it has responded to previous pruning, bearing in mind the underlying reasons for pruning (see *Traditional orchards: an introduction to pruning*).

First-hand practical experience of pruning and observing the tree's response to it over time is probably the most effective way of learning the process.

Different methods of pruning

Apples and pears respond better to pruning than other types of fruit tree such as stone fruits. Consequently many methods have been developed for pruning them. For free-growing standard trees there are three main types of annual maintenance pruning:

- regulated pruning;
- spur pruning; and
- renewal pruning.

All of these methods have their pros and cons. Generally, most pruning in traditional orchards will be carried out following the principles of the regulated pruning method. The spur and renewal pruning techniques were developed to increase fruit production in more commercial orchards. In practice, pruning may involve a combination of methods depending on the individual tree.

Regulated pruning

This is the oldest and most basic method of pruning standard trees. It evolved from the ad hoc methods traditionally used in extensive orchards where stock grazed the sward. Here, time available for tree pruning was limited and often restricted to winter while the production of large amounts of quality fruit was not as important.

Regulated pruning is fairly quick and does not require the skill of other methods. It is also the best method for maximising wildlife benefit, partly because it is carried out more extensively than other pruning methods. Most traditional orchards will be pruned following its basic principles.

Regulated pruning considers the tree as a whole rather than managing individual sections separately as with spur and renewal pruning (Diagrams 4 & 5). The tree is pruned with

consideration to its overall structure, entire sections of branches or limbs being removed rather than individual laterals or spurs. On a young tree, thin and weak shoots are removed but most are left unpruned. As the tree gets older, large sections or even complete limbs are removed but no detailed pruning is undertaken. Where the trees are being managed for conservation interests the use of **coronet cuts** should be considered.

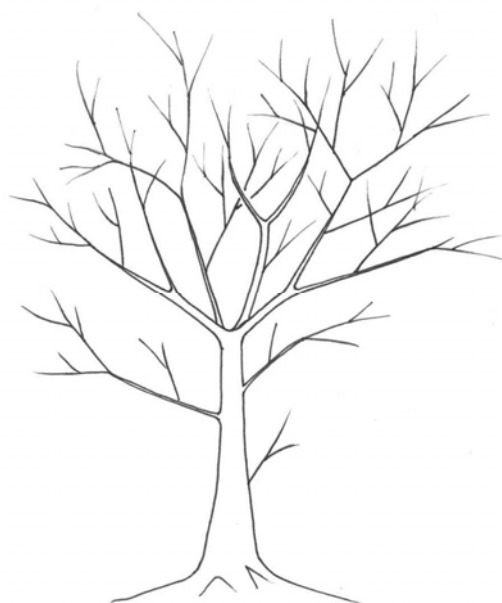


Diagram 4

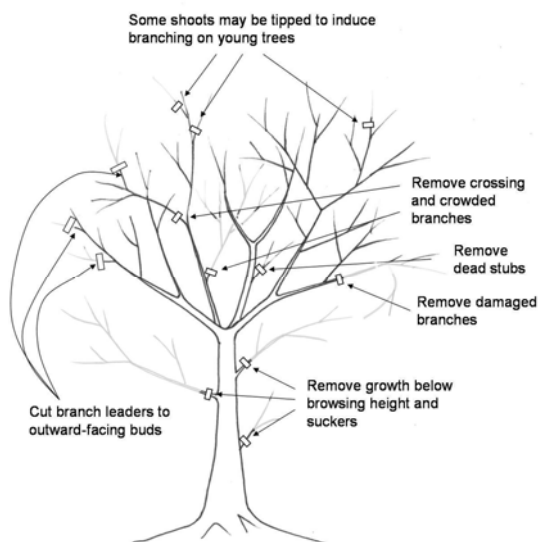


Diagram 5

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The aim is to open up the crown to let in light and air, so the framework branches and laterals do not crowd or shade one another. As a general rule, main branches on mature trees should be at least one metre apart when one is directly above the other and at least 60 cm apart when side by side. On younger trees these lengths can be reduced accordingly.

Branches should be selected for removal if they are:

- diseased and damaged;
- weak and unproductive;
- crossing;
- congested; or
- growing back to the centre of the tree.

Up to 20% of the wood should be removed each year to maintain a balanced tree. Depending on their condition, trees producing many small fruits at the expense of vegetative growth should be pruned harder. Those growing too vigorously should be pruned less severely.

Regulated pruning is particularly well suited for vigorous varieties where it is impractical to prune every new shoot each year. Where fruit quality and production is not as important or picking by hand is not necessary (for example in cider orchards), this may be the only pruning required. However, although regulated pruning prolongs the tree's life and improves fruit production compared to not pruning at all, it does not promote fruit size and quality compared to spur and renewal pruning. It may also lead to biennial bearing, particularly in pears.

Spur pruning

This method was developed to maximise fruit production. It can only be applied to spur bearing trees and involves close pruning to accentuate their natural growth habit and stimulate spur production. Spur pruning is easy to follow, but time-consuming. It is usually done in winter but can also be applied during the summer. Each branch is considered separately. The tree is shaped to form a network of permanent main branches on which both temporary fruiting side shoots (laterals) and established fruiting spurs are allowed to form. The aim is to develop spur

systems or temporary laterals at least 30 cm apart along the permanent branches.

With spur pruning, all vigorous maiden laterals that develop each year from the permanent branches are removed completely (unless required for forming new secondary branches) or left unpruned (to avoid stimulating more vigorous growth) and then removed the next year. A proportion of the weaker and flatter shoots are retained and cut back to approximately 8cm leaving 4-5 buds of the first year's growth. These remaining buds get fed over the winter which breaks their dormancy in the second year. The 2-3 buds at the base of the lateral develop into fruit buds, leaving the buds at the new 'tip' of the lateral to become growth buds and form new shoots.

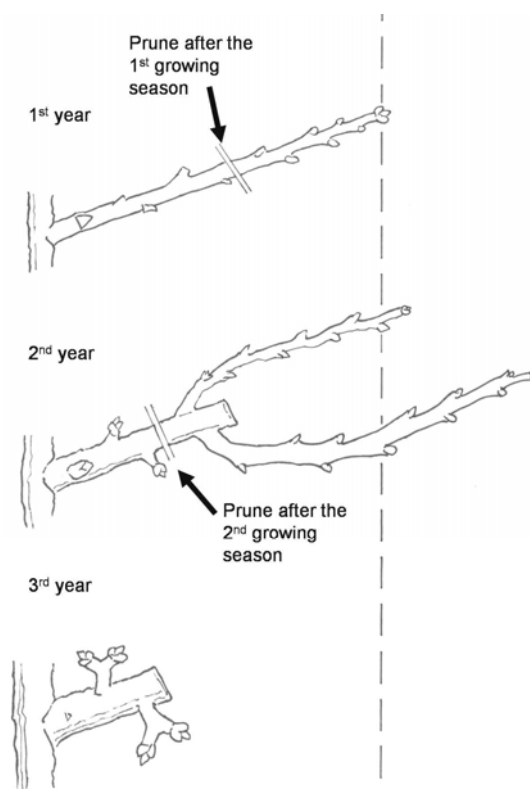


Diagram 6

At the end of the second year the lateral is shortened again, usually removing all the vegetative growth formed in the second year, to leave behind only the fruit buds that developed. However, if there is room and the resulting growth won't overlap another spur system, the lateral can be cut back to 4-5 growth buds to stimulate more growth and allow more spurs to

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form further down the lateral. In the third year the oldest fruit buds develop into spurs and bear flowers and fruit and in subsequent years build up the knobbly spur systems. Any new vegetative shoots arising from existing spurs are either cut back hard (to 2-3 buds) to stimulate more fruit buds, or removed completely.

Spur pruning can be applied across the whole tree but is best suited to inner branches with lots of existing growth as it doesn't require lots of strong vegetative growth. Continual spur pruning will eventually lead to the development of a congested mass of complex spur systems with dense, aged and overcrowded fruit bud clusters. Therefore, strong spurs have to be thinned and reduced in size after a further 1 to 3 years using secateurs. 20-25% of spurs should be removed completely each year, concentrating on weak, worn out and shaded spurs. This allows more light to the remaining spurs and encourages the development of fresh new spurs.

Renewal pruning

This system is effectively a compromise between regulated and spur pruning. It is the best method to use for pruning tip bearing varieties. As with spur pruning each branch is considered separately. There is still a framework of permanent branches but temporary branches are allowed to develop on them and then removed when they become too big or cease to fruit. Effectively, it follows a similar approach to regulated pruning but is applied to each limb individually rather than to the tree as a whole. As with spur pruning, vigorous and upright shoots are removed. However, short spurs are not encouraged and most maiden laterals arising from the permanent branches are allowed to develop unpruned. The aim is to form laterals roughly every 45 cm along each main branch.

In their second growing season the terminal (end) bud extends into further growth, while most of the remaining buds will develop into flower buds. At the end of the second growing season, these shoots are cut back to their topmost flower bud. The following (third) summer, they then flower and bear fruit. At the end of the third growing season these laterals may be removed completely in favour of new growth arising from dormant buds on the framework branches, or cut back hard to

2-3 buds to stimulate new growth the following year beginning the process all over again. Alternatively, some are left to bear fruit for a few years longer, forming elongated spurs.

The relative proportions of laterals either left to fruit or removed depends on the tree's vigour and quantity of fruit. If the tree is producing too much then more laterals are removed and vice versa. If a branch becomes too crowded then a higher proportion of laterals should be removed to open the tree up.

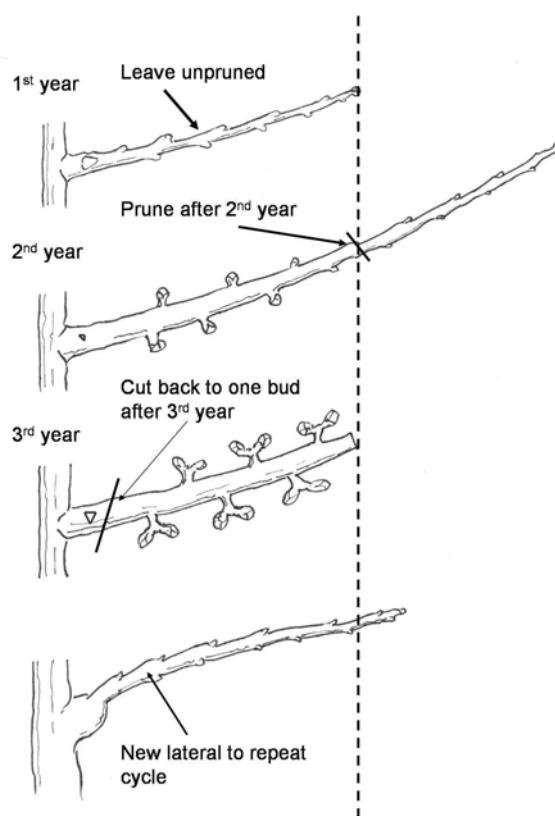


Diagram 7

Therefore, at any one time there will be present on each permanent framework branch:

- a number of maiden laterals left unpruned in their first winter;
- some two year old laterals which will be pruned back to their fruit buds in winter;
- some three year old laterals forming long spurs which will be fruiting for the first time;
- some four year or older laterals forming long spurs that have been left to fruit;

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- some long spurs which have been cut back to a stub; and
- some new growth arising from dormant buds that will form new laterals, or new branches if required.

Renewal pruning can be applied across the whole tree but is best suited for stronger laterals on the outer part of the tree where there is room to allow for strong vegetative growth. This method can also benefit overcrowded spur pruned trees by stimulating some fresh growth.

Modified renewal pruning

This variation is aimed at avoiding stimulating excessive growth at the expense of fruit. It is more suitable for vigorous tip bearing varieties (eg Bramley's Seedling). Fruiting laterals are not shortened to the fruit buds after their second year but left unpruned until they are ready to be removed completely, usually after four or five years.

Whichever method is used, under renewal pruning all of the tree's fruiting wood is renewed over a period of approximately three to five years. The continual removal of old wood stimulates the production of new growth, and this continuous supply of new fruit-bearing material ensures fruit size and quality remain consistent.

The severity of the pruning can be adjusted according to the vigour of the tree, weak trees being pruned harder than strong ones to stimulate growth.

Timing of pruning

Winter pruning

Winter pruning tends to promote shoot growth over fruit production. Standard apple and pear trees are normally pruned during the winter between late October and early April when all the leaves have dropped and the tree is dormant. This reduces the risk of fungal infection and does less damage to the tree.

Pruning in late winter is preferable as the wound is cut just before the new sap rises, enabling new growth to follow close on. It also reduces the risk of frost damaging the exposed tissues.

Pruning should be avoided during periods of heavy frost or unseasonably warm periods.

Summer pruning

Summer pruning suppresses growth and stimulates fruit production in its place. It can also help to cure biennial bearing. It is most commonly used in restricted systems which often produce more vegetative growth than desired, such as cordons, espaliers and dwarf pyramids and in intensive commercial plantations. In standard apple and pear orchards it is sometimes used in conjunction with winter pruning where regulated or renewal pruning is applied. The current year's growth is cut back on some or all of the laterals to about the sixth leaf from the base, but ignoring the leaf clusters at the base (leaders should be left until the winter prune).

This has two advantages. If carried out in June it reduces vigour, limits re-growth and helps restore the balance between shoot growth and fruit bud formation on vigorously growing trees (eg when removing water shoots on an over-pruned tree). If done after mid-August, as growth is slowing down and diverting energy from growth to fruiting, it allows in more light to the fruit and encourages their development. Heavy summer pruning can reduce the sugar content of the fruit however, affecting flavour.

Pruning other types of orchard tree

Pruning stone fruits

Stone fruits (plum, damson, cherry and gage) should be pruned to form an open-centred tree, in a similar manner to the regulated method used for apple and pear trees. They produce fruits at the base of maiden laterals and along the length of older stems so spur pruning is not suitable as this would remove the most vigorous fruiting wood.

As stone fruits are extremely susceptible to Silver Leaf fungus, pruning should be kept to a minimum and confined to the summer between May and early September while the tree is actively growing. This allows the rising sap to 'flush out' the wound which will also heal quicker, minimising the risk of pathogens entering and causing disease.

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It is usually sufficient to clean out any dead and damaged wood which forms under the canopy as this reduces light and forms a barrier of small scratchy branches which are a nuisance when picking. The weight of the fruit, particularly on plums, may be enough to require stronger, pruned branches.

Damson and plum branches become brittle when elderly, and very vigorous horizontal branches may require their ends trimming, to prevent them snapping off in later years in snow or storms.

Cherries should be pruned in spring just as the fruit buds are swelling. This helps distinguish them from smaller vegetative growth buds. Growing tips should be pinched out when new shoots have made five or six leaves.

Pruning cobnuts

The aim is to develop a bush/tree with approximately eight main framework branches restricted in height to 2 m. The object of maintenance pruning is to produce plenty of weak, horizontal flower-bearing shoots. These twiggy areas can be encouraged by completely removing any very strong growth. Moderately vigorous growth can be cut back to encourage weak side shoots. Older twigs that are too dense and shoots growing directly into the centre of the tree can be removed or reduced.

If a branch has become too tall or complex, a new shoot lower down should be selected and the branch sawn off above it. This will develop a new twiggy structure starting lower down. A wand can be used to form a new branch if required. All other wands should be removed.

Tall overgrown bushes can be restored to a more manageable size by heading back the main branches to a suitable lateral or bud. If all the wands that develop are removed promptly, overgrown bushes will produce useful crops again in about two years.

Pruning walnuts

Established walnuts should only be pruned with caution. They are particularly prone to dieing back after pruning and hard pruning is not tolerated. Any pruning should be carried out between mid-summer and early autumn. Pruning

should be avoided in late winter or early spring (January-April) as the sap rises early and cuts can bleed profusely.

To keep trees relatively compact and bushy, the new growth of the side branches can be pinched out at the fifth or sixth leaf every summer. Otherwise, where space is not limited, the tree can be allowed to grow unhindered with pruning kept to a minimum.

Pruning mulberries

As with walnuts, pruning should be kept to a minimum, removing the leader on a young tree and congested, crossing or damaged branches and over-dominant side shoots only. Pruning should be carried out over the winter.

Other pruning management techniques

Fruit thinning

In years when most flowers set, more fruits may develop than desired. An over-heavy crop can create a number of problems. On young trees it diverts energy away from vegetative growth and can bend thin branches, distorting or even breaking them. It can also lead to a crop of small, crowded fruit that are poorly ripened and prone to disease. Even on mature trees it can impose a strain on the tree's resources and could induce biennial bearing.

Apple trees often thin themselves naturally in a process known as 'June drop' but this may not be sufficient with varieties that are prolific fruited. The remedy is to thin the fruitlets by hand, by pinching them out when they are still small. Misshapen or damaged fruits should be removed, along with the central fruitlet in each cluster, to leave single or double fruits evenly spaced at a distance of 10 cm. This gives them more space and light to develop. Yields may be smaller in quantity but will be superior in quality and overall weight. Apples and plums need thinning more than other fruits.

Bark ringing

The aim of bark ringing is to reduce the amount of nutrient being carried up the tree. This reduces its vigour and vegetative growth, while at the same time retaining the sugars that help in fruit development.

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It is carried out at blossom time and involves removing two strips of bark from the trunk at about 60 cm above ground level. The first strip should be 1.5 cm wide and cut down to the hard heartwood and run at least two thirds around the trunk. A second strip should be cut some 5 cm below the first, running a similar distance around the trunk but with its opening on the opposite side. This can be risky however, as pathogens may get into the wound and cause disease.

Further information

This note is aimed at managers of traditional orchards and agri-environment scheme land management advisers. Other Natural England Technical Information Notes include:

- *Traditional orchards: maintenance pruning*
- *Traditional orchards: site and tree selection*
- *Traditional orchards: planting and establishing fruit trees*
- *Traditional orchards: an introduction to pruning*

- *Traditional orchards: formative pruning of young trees*
- *Traditional orchards: restoration and management of mature and neglected orchards*
- *Traditional orchards: fruit tree health*
- *Traditional orchards: orchards and wildlife*
- *Traditional orchards: glossary*

This leaflet was written by Chris Wedge, Natural England, Burghill Road, Westbury-on-Trym, Bristol, BS10 6NJ, tel: 0117 959 1000. Illustrations by Paul Lacey.

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