# Planting Guide

## A guide to tree longevity in the landscape

By Appointment
To Her Majesty The Queen
Specialist Container Tree Growers
Barcham Trees PLC, Ely

By Appointment
To His Royal Highness The Prince of Wales
Specialist Container Tree Growers
Barcham Trees PLC, Ely

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# Introduction

Planting trees to achieve longevity in the landscape, especially the harsh urban landscape, is challenging and often represented as so difficult as to be impossible. There is no question that there are challenges and the difficulties should never be underestimated but it is true, in the words of Tony Kirkham, 'It is really difficult to photograph a well planted young tree and really easy to photograph a badly planted one.' Experience suggests that this is not an exaggeration and my own library of photographs would reinforce this view.

The purpose of this manual is to try to strip away some of the mythologies which constitute the plethora of advice and commercial products surrounding tree planting and outline some of the base principles. It is often these base principles which are either misunderstood or badly executed.

Planting techniques vary according to the size of the tree, the nursery production method, the location and individual site constraints and several other factors but there are fundamentals which apply irrespective of any of the above.

This manual attempts to outline commonalities which are essential to successful tree planting. It then explains the principal nursery production methods to be found in the UK and goes on to explain in detail the planting of containerised trees in both soft and hard landscapes. The focus of this detail will be on containerised trees as this is 'what Barcham does.' No case is made for the advantage of any one production system over another and the commonalities apply to all nursery production systems.

There are also sections on nutrition and soil ameliorants, support systems and post planting maintenance and management.

The manual is not intended to be a reference work but a guide. Throughout, the user will be guided to references and further reading where specialist advice or specific challenges need to be addressed.

The intention is to focus on the basics. I hope you, the reader, will find this manual useful and stimulating in some small way and encourage further reading on the subject.

It would be brilliant if the statement made by Tony Kirkham can be reversed and photographing well planted trees could become the norm rather than the rarity.

Keith

Keith Sacre

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# 1.0

# Nursery Production Systems

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# 1.0 Nursery Production Systems

There are three principal nursery production systems used in the production of standard trees and larger in the UK. Each of them are equally effective but each has advantages and disadvantages in terms of achieving longevity in the landscape.

*Bare root system prior to planting*

*Rootballs lifted and prepared ready for despatch from the nursery*

*Comparison between bare root, rootball and container*

These advantages and disadvantages are set out in the tables below.

| Production System | |
|---|---|
| **BARE ROOT**<br>(Open ground) | |
| **Advantages** | **Disadvantages** |
| The cost of production is lower when compared with other methods, and this is reflected in the supply cost.<br><br>Bare root trees are lighter than rootballed containerised equivalents and are therefore easier and more economical to handle, transport and plant.<br><br>They are less likely to contain soil-borne disease than trees supplied with soil.<br><br>This is the best production system for identifying and correcting root deformities prior to planting in the landscape. | The appropriate time for lifting from the nursery field and transplanting into the landscape is limited to the dormant season.<br><br>Not all species are tolerant of the technique.<br><br>A significant proportion of fine roots might be damaged at lifting and during transport.<br><br>As a general rule, the larger the bare root tree within a given species, the higher the mortality rate, with survivors slow to recover.<br><br>Field soil conditions can limit times of lifting and planting, with frozen, very wet and very dry soils being unsatisfactory.<br><br>Handling and care of bare root trees between lifting and planting is critical to achieving good survival rates. Roots need to be kept moist at all times, and where there is a delay between lifting and planting, the roots need to be heeled in.<br><br>Bare root trees are lifted directly from the field. Each field is part of a crop cycle with lifting occurring over a two/three year period. Often the best trees are lifted first.<br><br>Evergreen trees are rarely moved as bare root specimens. |

| Production System | |
|---|---|
| **ROOTBALL**<br>(ball and burlap) | |
| **Advantages** | **Disadvantages** |
| The lifting and transplanting season is extended when compared to bare root trees.<br><br>Trees that have poor survival percentages when handled bare root can be transplanted successfully.<br><br>Trees may be lifted from the nursery field ahead of time and stored above ground if handled correctly. This extends the period for planting beyond the dormant season.<br><br>Care between lifting and planting is less critical than for bare root trees as the roots are ideally kept moist and frost-free within the rootball. | If the nursery practice is poor then as much as 95% of the root system can be lost on lifting.<br><br>Actual lifting from the nursery field is limited to the dormant season for all but a very small number of tolerant species.<br><br>Handling of large rootballs is labour intensive with rootballs being heavy and awkward to transport.<br><br>If the rootball is broken or allowed to shift during handling and despatch, the chances of tree survival are reduced.<br><br>Field soil conditions can limit times of lifting, with frozen, very wet and very dry soils being unsatisfactory.<br><br>Rootballs are generally more expensive than bare root trees.<br><br>Successful transplanting and longevity in the landscape can be adversely affected if the primary root or root flare is too deep within the rootball as a result of poor nursery production.<br><br>This is the worst tree production system for identifying and correcting root deformities prior to planting. |

| Production System | |
|---|---|
| **CONTAINERISED TREES** | |
| **Advantages** | **Disadvantages** |
| The root system is entire and undamaged when it arrives at the planting site.<br><br>Containerised trees can be planted at any time of the year, although soil conditions in the summer can be a limiting factor.<br><br>The trees are generally easier to handle than rootballed trees.<br><br>The trees are generally easier to store than trees from other production systems.<br><br>Post-transplanting stress and shock is reduced to a minimum, consequently achieving earlier benefits from planting.<br><br>Containerised trees generally weigh less than rootballed trees, as the growing media used is usually organic rather than soil based.<br><br>Trees are not lifted directly from the nursery field for despatch and are unlikely to have suffered root damage.<br><br>Irrigation and nutrition can be regularly monitored and easily adjusted throughout the production process on the nursery and any subsequent storage period prior to planting.<br><br>Trees are grown in a controlled environment throughout the production process. | Additional irrigation might be needed during the post-transplanting maintenance period.<br><br>The organic soil-less compost used in containerised mixes can shrink if allowed to dry out.<br><br>There is the potential for root circling and subsequent root girdling. This is true of all container production systems irrespective of container type. If a tree is left in a container for too long, its roots fill the pot and become distorted.<br><br>If lifted for despatch too early there is a risk that root formation in the container will not be complete and compost will fall away leaving an exposed root system at the time of planting.<br><br>Some containerisation systems involve the root system being moved from production to despatch packaging. This movement can result in drying out and or root damage.<br><br>Containerised trees are generally more expensive than bare root or rootballed trees.<br><br>Movement from smaller to larger containers can result in root deformation and delayed failure in the landscape.<br><br>Containerisation can result in the root flare being buried too deep in the container. |







*A containerised tree root system on removal from the container prior to planting*

A full discussion and comprehensive outline of each of the production methods can be found in BS8545 Trees: From Nursery to Independence in the Landscape 2014.

Planting techniques have to be modified to accommodate the specifics of each production system but there are commonalities which apply irrespective of the production system. These commonalities will be discussed in the next section.


# 2.0

# Common Factors

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## Prior to Planting

*Underground services, one of the constraints found with urban planting*

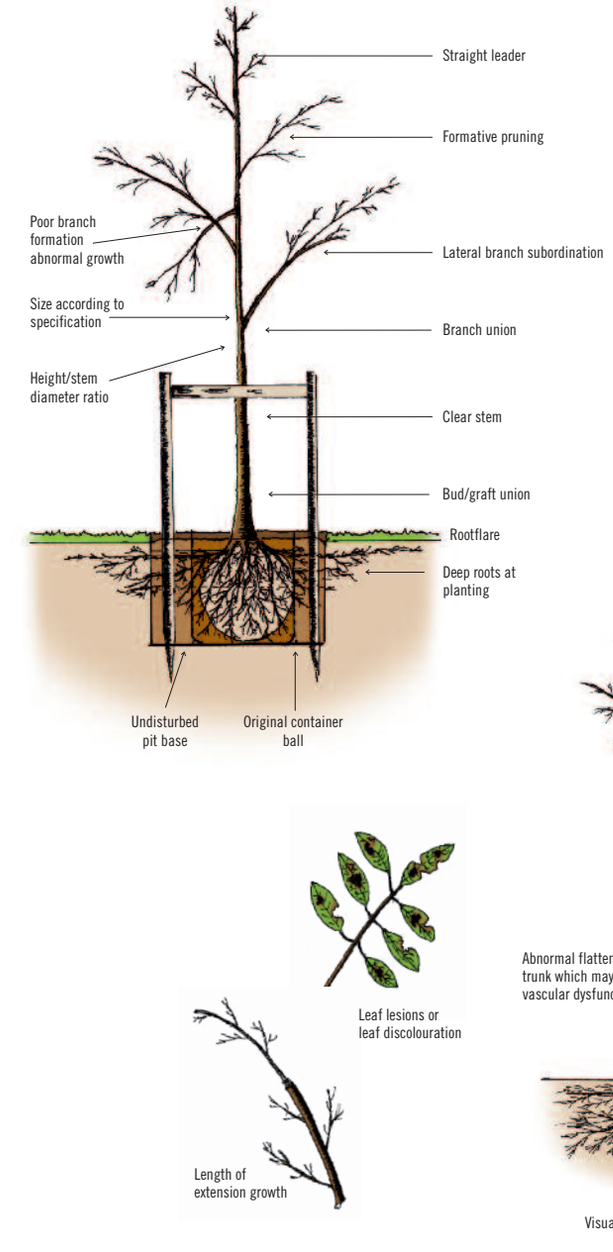
**Site Constraints:**
All planting sites have constraints. These may be associated with substrate volume, soil type, drainage, compaction, pH, urban infrastructure including buildings and underground services and localised environmental conditions.
All of these factors should be assessed and ameliorated where ever possible prior to any planting being considered.

**Species selection:**
Once site constraints have been ameliorated as far as possible then the appropriate species for the site can be selected. Individual tree species originate from different parts of the world, have inherent characteristics and natural tolerances, display different growth rates, provide different levels of ecosystem services, vulnerability and resistance to pest and disease as well as many desirable aesthetic characteristics. Careful consideration should be given to species choice as failure to do so can result in planting failure.


## Tree quality and tree health

It is important that the tree to be planted, irrespective of the production system, is of good quality and in optimum physiological health. Quality is a nebulous term but can be specified. Features which can be inspected prior to planting include: bud graft union, straight, well defined leading shoot, well balanced crown formation - free of poorly attached branches with included bark, subordinated lateral branches, defined stem taper and a balanced height/stem girth ratio.
Below ground; bare root trees should have a well-balanced radial root system comprising at least four obvious and substantial lateral roots and containerised trees should be free from circling, girdling or descending roots. It is difficult to assess the roots in a root ball as breaking the ball is the only way to carry out an assessment. This check could be performed on a limited sample of both rootball and containerised trees at the point of delivery.

*Diagram 1 - Features which can be inspected prior to planting*




Visual indicators of poor health which can be inspected prior to planting

Tree health can be assessed both on the nursery and prior to planting in numerous ways. These are largely visual and assess morphological characteristics and are only as effective as the level of expertise of the assessor. Items which can be assessed include significant leaf lesions or abnormal discolouration, defects in the crown structure, foliar density and size atypical from the species, current and previous extension growth, abnormal abrasions or large old pruning wounds, abnormal adventitious bud development and vigorous epicormic growth from the rootstock. The physiological condition of young trees can be assessed using leaf fluorescence and chlorophyll content.

Arborcheck®
analytical stress diagnostics

**Substrate/soil volume:**
All trees need space for root-system development and growth. As much soil/substrate volume should be allowed for tree root development as is possible.

Methods of calculating the soil volume necessary to support optimum tree growth are based on an estimation of the water use of the mature tree crown of the species being planted. This information is then coupled with the known water holding capacity of the soil type present at the planting site to calculate the volume of soil necessary to hold that amount of water.

Estimations based on this method and variations of it predict that a large tree will require 28 cubic metres of soil, a medium tree 18 cubic metres of soil and a small tree 9 cubic metres of soil. Unfortunately, these minimum volumes often become the maximum even if more space is available. It also has to be accepted that in many instances these soil volumes are impossible to achieve as is the case with many urban retro-fit plantings; here there is an expectation that the trees will not reach their full genetic potential. Whilst this may be the case, it does not detract from the importance of such plantings.

## Planting

**The Planting pit and backfill medium**
Planting practices have improved over time and many mythologies which were common practice have now been shown to be either unnecessary or detrimental to healthy tree growth post planting.





It was once common practice to disturb the bottom of the planting pit often working in organic material. It has been demonstrated that such disturbance can lead to subsequent settling of the planted tree resulting in the root flare becoming too deep. Unless there is a significant problem such as poor drainage or significant deep compaction, which should be rectified prior to planting, the base of the pit should remain undisturbed. Where space is available it has been demonstrated that a wider planting pit is more beneficial than a deep one.

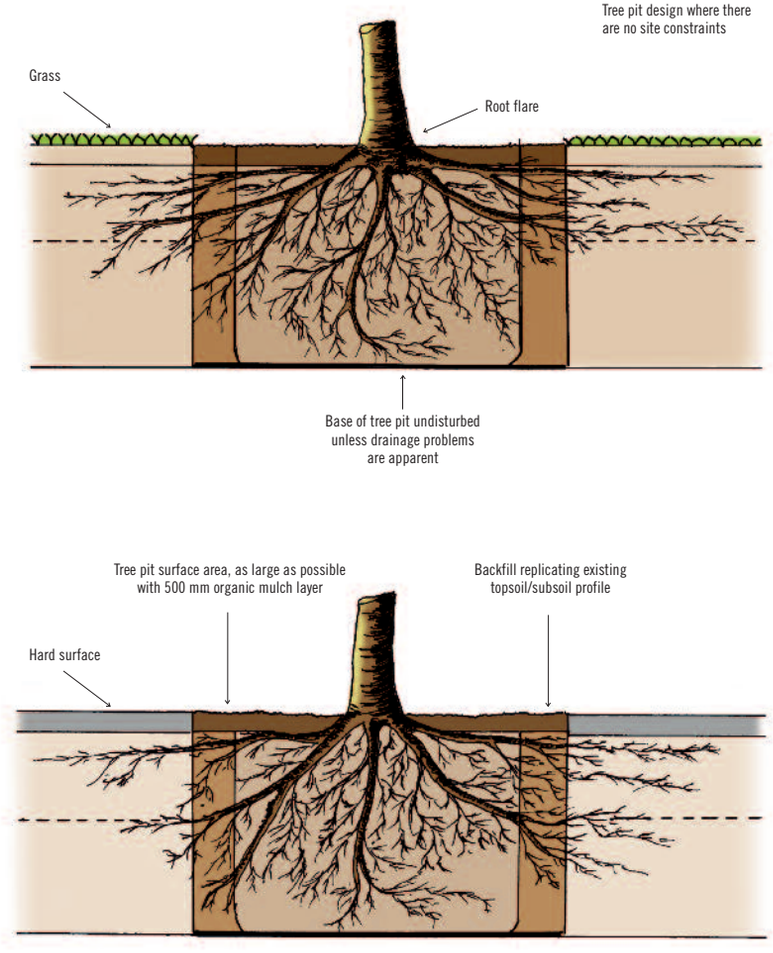



*Diagram 2 showing undisturbed base of planting pit in soft and hard landscapes*

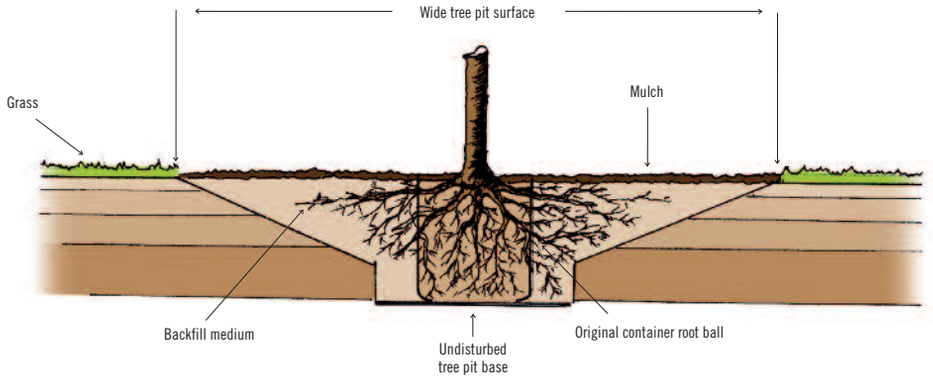



*Diagram 3 showing wide tree pit*

It is often the case that tree planting pits will be excavated mechanically using power augers or similar. This can result in the sides of the pit becoming glazed and impossible for developing tree roots to penetrate. Where machinery is used the side walls should be loosened manually prior to planting. Glazed sides of the tree pit can result in tree roots unable to escape and subsequently circling and girdling leading to future instability and eventual failure.

There has been discussion about the shape of the actual planting hole and a school of thought has developed that this should be square allowing roots to escape from the confines of the pit at the corners of the square hole. While this practice is not detrimental to tree root growth there is little evidence to suggest that it is essential providing roots are not trapped by glazed side walls or other constraints.

The subject of back-fill amendments attracts much comment. On a site with high quality soil it is unlikely that soil amendments will improve tree root development. Even on sites with poor soil it has been demonstrated that the simple excavation and working of the soil can improve soil structure and there will be some mixing of top soil with sub soil although these should be largely kept separate and returned to the planting pit at the depth they were excavated.

On harsh urban sites some form of soil amendment may be beneficial, with the addition of well composted organic material and sand able to amend heavy clay soils. The necessity of soil amendment should be assessed at each site and not prescribed as a universal requirement for all planting sites.





One common and often repeated mistake is to specify high quality top soil as a back-fill medium to the full depth of the planting pit. High-quality top soil does not have the structural integrity to function at depth and will quickly collapse becoming anaerobic and impenetrable to tree roots. Backfill soils, where possible, should mirror the existing soil profile. Where such profiles are not apparent backfill soils with varying structural characteristics should be used creating a soil profile capable of functioning at different depths with good quality top soil apparent as the upper layer.

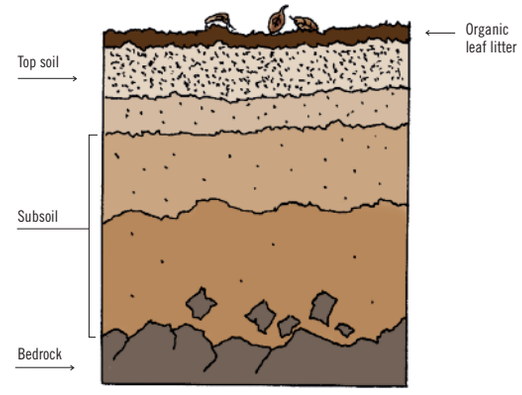



*Diagram 4 Simplified soil profile showing different horizons. Each horizon has different soil characteristics. It is this variation which should be replicated in the planting pit backfill*

*Shows a root from a dead Lime tree where anaerobic conditions have prevailed.*

Research has demonstrated that the use of high polymer gels to increase the available water to newly planted trees does not consistently increase the root and shoot growth of trees after planting.

## Planting depth

The planting depth of the tree is the most common mistake made when planting.  As a generalisation the root flare, which culminates at the widest point of the stem taper of the tree, should be clearly visible at the surface of the planting hole post planting. Stem taper and root flare development vary with species and age.

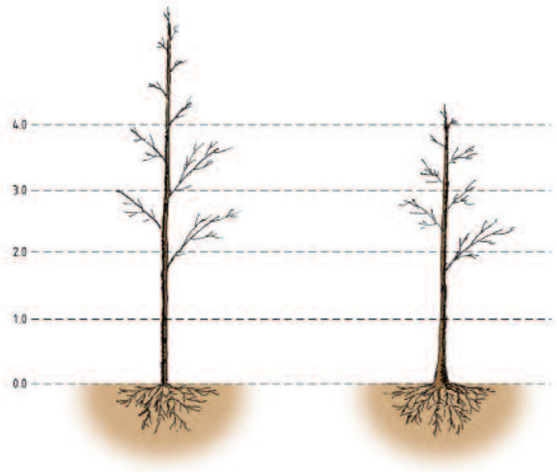
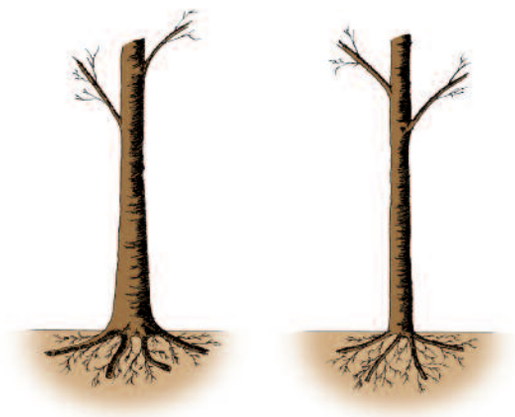



*Diagram 5  Tree on left with poor height stem girth ratio and undeveloped stem taper. Tree on right with well developed stem taper and good height stem girth ratio.*



*On the left well developed stem taper, on the right not so well developed.*





The consequences of deep planting vary with species and location. It has been reported that deep planting has been associated with greater defoliation, chlorosis, leaf curl, collar rot, basal canker and has been associated with an increased frequency of girdling roots. It has also been observed that the impact of deep planting may be accentuated on sites with heavy, poorly drained soils.

The impact of deep planting is insidious with the deterioration, and in some instance failure, of the tree occurring over a number of years post planting. It is better to get the planting depth correct at the time of planting and to apply this principle to the planting of all species on all sites.

## Post Planting

### Support Systems

The type and variety of support systems will be examined more fully in section 6.0.
It is essential to remember that any support system is a temporary feature to stabilise the tree while the root system develops, and the tree becomes self -supporting.

### Post planting treatments

These will be examined more fully in section 7.0.

Source material and further reading on the above topics:


- *A Time for Trees: Barcham Trees*
- *A Guide to Tree Species Selection. Trees and Design Action Group (TDAG)*
- *An Illustrated Guide to Pruning, Third Edition: Edward Gilman. Delmar, Cengage Learning.*
- *Applied Tree Biology: Andrew Hirons and Peter Thomas: Wiley Blackwell*
- *Barcham Species Selection Manual*
- *Barcham Trees: Specification Manual. A Guide to Specifying young trees from the nursery*
- *BS 8545 Trees: From Nursery to Independence in the Landscape 2014*
- *James Urban: Up by Roots, Healthy Soils and Trees in the Built Environment. 1971. ISA publications.*
- *Recommended Urban Trees: Site Assessment and Tree Selection for Stress Tolerance. Nina Bassuk et al. Cornell University.*
- *The Practical Science of Planting Trees: Gary Watson and E.B. Himelick. ISA publications.*
- *Trees for Tough Urban Sites. Dr Henrik Sjoman. Swedish University of Agricultural Sciences.*
- *Trees in the Urban Landscape. Site Assessment and Tree Selection, Design and Installation. Peter Trowbridge and Nina Bassuk*
- *www.arborcheck.com*

# 3.0

# Planting Containerised Trees in Soft Landscapes

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# 3.0 Planting Containerised Trees in Soft Landscapes

As stated in the introduction the sections on planting will focus on containerised trees because this is the specialism of Barcham Trees.

All of the elements outlined in the section 'common factors' apply when planting containerised trees.

One of the most discussed factors and potential problem associated with container grown trees is that of circling, girdling and downward growth of the root system produced when the developing root system comes into contact with, and is diverted by, the container side wall and base. Much of the research in this area has been on container grown trees, where trees are moved throughout their production from smaller to larger containers.


*Extreme root girdling caused by being in the same container too long*

*Another example of extreme root girdling caused by being in the same container for too long*





# Planting Containerised Trees in Soft Landscapes 3.1

*Trunk fracture 10 years after planting caused by root girdling*

Problems occur when the developing root system begins to become woody and the growth pattern established in the container is transferred into the landscape. The newly planted tree roots continue to grow in the pattern established in the container, with inhibited lateral root development into the surrounding soil or substrate. In extreme cases, this can result in instability and failure, which may not materialise for many years, as the tree develops in the landscape.

Containerised trees, differing from container grown trees, are trees that are lifted from the nursery field and grown on for a period prior to despatch for planting. The roots are pruned between lifting from the field and being containerised. At the pruning stage all defective and potentially circling roots are pruned out. What goes into the container is a root system equipped to grow laterally.

Soft Landscapes

*Early stages of root circling and girdling caused by being in the same container for too long*

All containerised tree production, irrespective of the container type, will re-direct roots with potential problems occurring as the root thickens and becomes woody. **It is not containerised tree growing or the type of container which is crucial, it is the length of time a young tree is kept in the container.** At Barcham we have introduced a concept called **'shelf life'** which is designed, as far as is possible, to reduce the likelihood of roots being distorted at the time of planting by controlling the amount of time a tree will spend in the container.

The exact date of containerisation is recorded, and each tree species is grown on in the container for a prescribed period of time. Trees which have been in their containers beyond their **'shelf life'** period are culled as it is known that root distortion is likely to occur.

Despite this it is inevitable that some roots will hit the side wall of the container. It is recommended that prior to planting, once the container has been removed, the container ball is **'shaved'** by up to 20mm around its entire circumference and across the base. This is not essential but is an added precaution to ensure that roots are encouraged to grow laterally. It takes approximately one and half minutes to shave a 45 litre container.







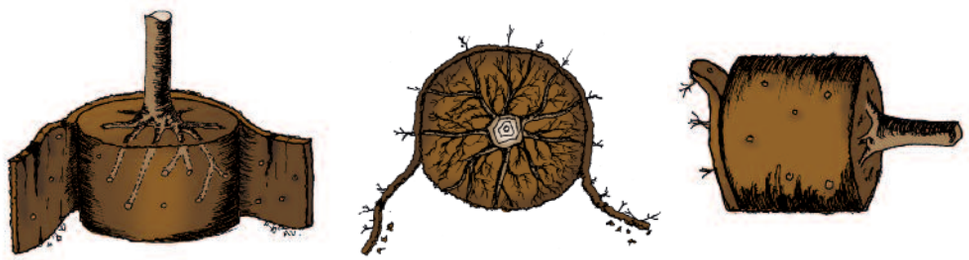

*Diagram 1 Shaving outer rim of container ball to remove any potentially circling roots leaving roots system ready for lateral development*

The whole process of planting a containerised tree in the soft landscape is illustrated in the following photos.

*The first stage in the planting process is to remove an area of turf. This one is one metre diameter, but should be adjusted according to the container size being planted.*

2

*The planting hole is dug with the base of the pit undisturbed. If machinery is used there is the potential for the side walls of the pit to become glazed. This glazing of the side wall should be broken up prior to planting.*

3

*The tree is removed from the container; which should have been kept moist prior to planting and not allowed to dry out at the planting site. Young non-woody roots can be seen going downwards where they have met with the side wall of the container. While not problematic at this stage they do have the potential to cause problems as the tree develops in the landscape.*







4

*To ensure all roots are facing laterally the outside of the container ball is shaved using a small saw or spade.' This eliminates any root distortion caused by contact with container wall.*

5

*A similar exercise is carried out across the base of the container to remove roots which may have become distorted at the base of the container. As stated earlier in this manual these operations are not essential but are to be recommended, as the ideal root system is one where roots are encouraged to grow laterally out into the back-fill soil and beyond. Circling and downward growing roots have the potential to cause problems later in the life of the tree.*


*The shaved root-ball is placed in the planting pit and the tree positioned. It is at this stage that support systems would be introduced and put in place. For simplicity these have been left out of this sequence of photographs but are discussed later in this manual.*


*The back-fill is added and the container ball firmed in place. The surface of the container ball is left approximately 10mm proud of the back-fill level. This is to accommodates the mulch without burying the root flare.*








*A 5 to 7.5 cm mulch is applied to the surface area of the original circle where turf was lifted. At this stage the tree should be watered slowly with water percolating through the worked soil profile.*

The same methodology as outlined in diagram two is followed irrespective of the size of the tree to be planted. It has to be remembered that the larger the tree the more difficult it is to move and plant. Specialist lifting and moving equipment will be necessary and it is advisable that a specialist is employed to carry out the work.

Source material and further reading:


- *BS 8545 Trees: From Nursery to Independence in the Landscape 2014.*
- *Barcham Trees: Specification Manual. A Guide to Specifying young trees from the nursery.*
- *James Urban: Up by Roots, Healthy Soils and Trees in the Built Environment. 1971. ISA publications.*
- *The Practical Science of Planting Trees: Gary Watson and E.B. Himelick. ISA publications.*
- *An Illustrated Guide to Pruning, Third Edition: Edward Gilman. Delmar, Cengage Learning.*
- *Applied Tree Biology: Andrew Hirons and Peter Thomas: Wiley Blackwell.*
- *Plant Production in Containers: Carl E Whitcomb. Lacebark Publications 1984.*
- *Landscape Below Ground, Volumes 1,2,3. Edited by Gary Watson et al. ISA Publications.*
- *Urban Tree Management for the Development of Green Cities: Edited by Andreas Roloff, Wiley Blackwell. 2016*

# 4.0

# Planting Containerised Trees in Hard Landscapes

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# 4.0 Planting Containerised Trees in Hard Landscapes

The planting of trees in the hard landscape is essentially the same as outlined in the last section with one or two significant variables.

Where trees are to be retrofitted into the hard landscape, for example at the side of the highway, space is likely to be severely restricted with the surface area for water percolation and gaseous exchange equally restricted. There are likely to be other site constraints such as underground services to be addressed prior to planting but the technique is the same.

Backfill medium is likely to be imported and therefore it is important to take into consideration the characteristics of the imported backfill medium. This has already been discussed in section 2 titled 'Common Factors'.

The retrofitting of trees into the hard landscape is an essential element in the maintenance of the urban treescape and is likely to remain so. Specific research is sadly lacking.

When planting in the urban environment many modifications and engineered solutions are available to create load bearing surfaces, increase available soil/substrate volume, facilitate more effective sustainable urban drainage systems, realise podium planting and to cater for a whole range of other site- specific aspirations. It is beyond the scope of this manual to examine any of these in detail. The installation of engineered solutions is site specific and requires expert guidance as to the type and appropriateness of such solutions. The assumption that a system used successfully elsewhere will provide a solution to an immediate aspiration should be avoided. For example, the Stockholm Structural Soil system, based on the use of stone layers is unlikely to be directly transferrable to the fens of East Anglia.

*Installation of engineered solution in St Peter's Square, Manchester*

*Successful planting in St Peter's Square, Manchester*







*Installation of the Stockholm Structural Soil System*

*Successful tree planting in Stockholm using structural soil*

The most important thing to remember is that solutions are specific to a particular site and that manufacturers and other specialist advice should be sought before embarking on any particular course of action. The Trees and Design Action Group's 'Trees in the Hard Landscape, A Guide for Delivery' devotes a whole chapter to the subject entitled 'Technical Design Solutions'. In the guide there is an impartial discussion of the solutions available and several case studies showing where they have been used successfully.

As solutions become more complex it is easy to forget that the purpose of the process is to achieve healthy long-term tree growth. The basic requirements of the tree remain the same and the engineered solutions are a means to an end and not the end in itself.

For further reading and guidance:


- *Trees and Design Action Group. Trees in the Hard Landscape A Guide for delivery. 2014.*
- *James Urban: Up by Roots, Healthy Soils and Trees in the Built Environment. 1971. ISA publications.*
- *Tree Roots in the Built Environment. Research for Amenity Trees No 8. 2006.*
- *Britt Marie Alvem and Bjorn Embren. Planting Beds in the City of Stockholm. Municipality of Stockholm (2009).*
- *BS 8545 Trees: From Nursery to Independence in the Landscape 2014*

# 5.0

# Nutrients & Soil Additives

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# 5.0 Nutrients & Soil Additives

Much has been written about the addition of nutrients and other soil additives/ameliorants at the time of planting. These include, fertilizer, mycorrhiza, bio-stimulants, sugars and hydrogels.

The evidence in support of the addition of such additives at the planting stage is limited and varied.

**Fertiliser:** It is generally agreed that in most cases the addition of fertilizer at planting, or in the first few years following planting, will not improve survival or growth. It would appear that a lack of sufficient water limits the growth of newly planted trees more than any other factor. It has been shown that until the root system can grow and absorb more water the adding of nutrients is of limited value. Both surface mulch and any organic material added to the back-fill medium are likely to be sufficient to meet the needs of the newly planted tree.

*Healthy, young Quercus palustris on a traffic island*







**Mycorrhizal inoculants:** The benefits of mycorrhizal association with tree roots is accepted and undeniable but it is also widely appreciated that the addition of mycorrhizal inoculants at the time of planting is of limited, if any benefit, to the newly planted tree. Even on harsh urban sites it has been found that mycorrhizas are present in the soil and that colonisation can increase without inoculation following planting.

**Bio-stimulants:** These include growth hormones, vitamins, sugars, amino acids, humic acids, and the extracts of plants.

The application of organic products such as humates and plants extracts has shown limited or no benefit to the root or shoot growth of trees. Some sugars can increase root and shoot dry weight or increase root shoot ratio, but results are inconsistent among tree species and sugar types used. Biochar has shown promising results being a porous, high carbon form of charcoal which alters the structure of the soil and apparently increases water holding capacity and increases the refugium available for naturally occurring micro-organisms that promote tree growth.

**Antitranspirants:** These are foliar sprays which reduce which reduce water loss through the leaf surface by producing a film on the leaf surface which reduces transpirational water loss. Some may be detrimental if used poorly but have been used successfully in some instances for summer transplanting and evergreens have been protected from winter desiccation. These should be used with care and certainly not as a matter of routine where their application is unnecessary.

It will be apparent to those reading the horticultural or arboricultural press on a regular basis that the list of additives which might be added at planting are almost endless. It is wise to understand that there is no magic elixir which will guarantee success and if the basics, such a soil conditions, tree quality, species choice and post planting maintenance, are given due attention in both theory and practice, most additives, other than organic mulch, are unnecessary at planting.

# 6.0

# Support Systems

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# 6.0 Support Systems

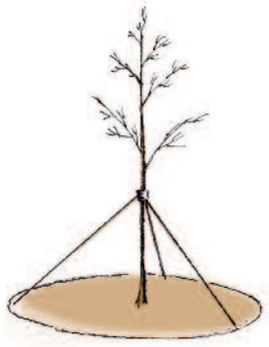
There are many varied support systems available. These range from the single stake through to complex underground guying systems.

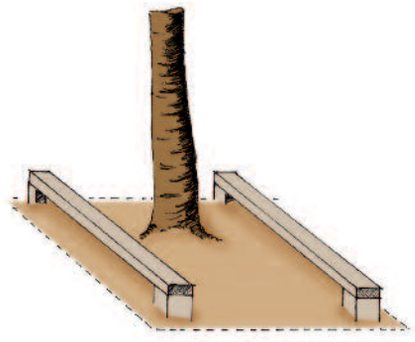
The choice will depend on the site and size of the tree and, providing manufacturers instructions are followed in the more complex systems, all will work. Often though it would seem that this work is forgotten and is worth clarifying. The purpose of a support system is to stabilise the newly planted tree until the root system has extended sufficiently to do this itself. Support systems are not a permanent feature, they are temporary and should be removed as soon as possible (this will of course not be possible with underground guying systems and natural decomposition should be favoured where sites allow).

Photographs showing poorly planted new trees have already been mentioned in the introduction to this manual. It is amazing how often stakes, ties and other support systems have been left in place far too long and are in fact threatening the health and longevity of the trees they were meant to stabilise.

The same argument can be made when considering grates, grills, cages and other furniture used to protect young trees. It is beyond the scope of this manual to discuss the equipment which protects the newly planted tree, but these items are also temporary and not desired features in themselves. This is sometimes forgotten, and it seems that often the colour, texture and appearance of a tree grill is considered more important than the tree it is there to protect.

Set out below and to the right are a series of diagrams illustrating various types of tree support systems. An accompanying series of photographs was going to be included illustrating the damage caused by tree supports left in place for too long. This is, however, depressing and it is almost certain that the reader will be able to find local examples within a very small distance from where this is being read.



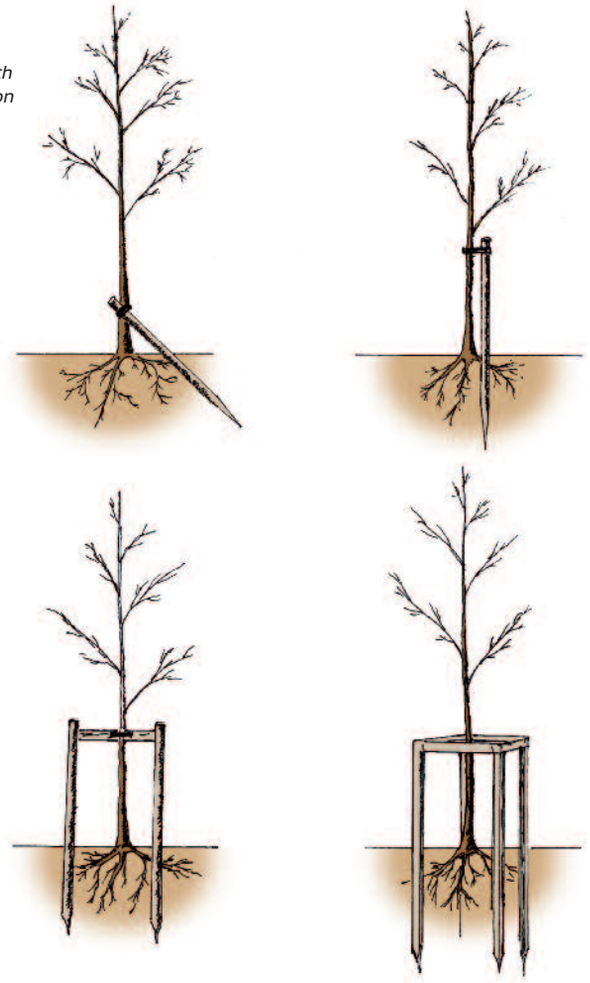




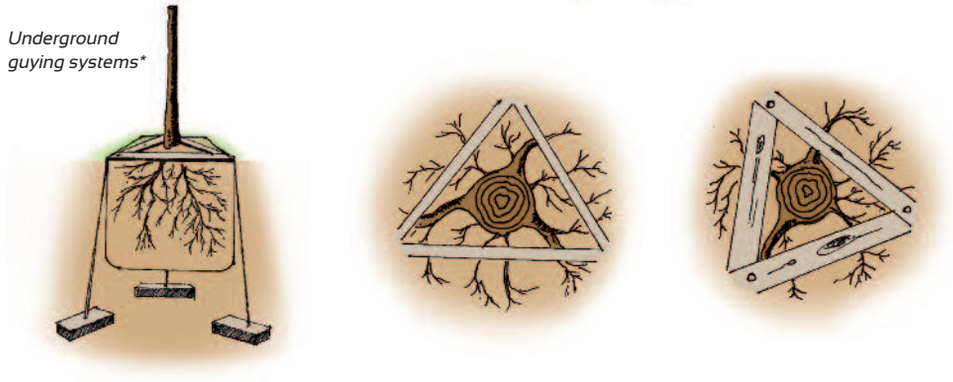




*Support system with details of installation*



*Underground guying systems**



**It should be remembered that the tensioning of underground guying systems can cause or exacerbate deep planting*

# 7.0

# Post Planting Management and Maintenance

Barcham
The Tree Specialists

# 7.0 Post Planting Management and Maintenance

Post planting maintenance and management is critical if longevity in the landscape is to be achieved. Landscapes, in particular urban landscapes, are littered with young trees which although alive, do not grow. The young tree, once transplanted, has only partially completed its development. It has been carefully nurtured on the nursery by growers and moving forward management in the landscape has to be viewed as part of the growing process. The nursery tree is not the finished article, but a stage in the life cycle development of the tree and managed growing and nurturing has to continue into the landscape.

Maintenance can be categorised into groups. These are irrigation, compaction, pruning and the management of support systems and protective furniture.

**Irrigation:** There is no simple formula which will provide the answer to 'how much water should I apply and when.' There are many variables which include; amount of rainfall, permeability of surfacing, daily temperatures and wind conditions, moisture holding capacity of the soil/substrate, drainage, size and species of tree planted and the nursery production system.

Root growth stops in most species when soil moisture is reduced to 14% on an oven dry weight basis. Root suberization is accelerated in dry soil and the full capacity for water uptake is not achieved until new root tips are produced. On re-watering, even if immediately after the cessation of root elongation, roots might not begin to grow for at least a week. The resumption of root growth can be delayed for as much as 5 weeks if water is withheld for longer periods. If a soil becomes too dry, then some of the smaller roots might die.


*Hydration bag*

*Watering bag*





# Post Planting Management and Maintenance 7.1

Each soil has the capacity to hold water as well as to release it for tree use. A soil's capacity to release water is different from a soil's capacity to hold volumes of water. Therefore, both volumetric and matric (capacity to release water) potentials of a soil need to be understood when calculating irrigation need. The matric potential is determined by characteristics such as texture, parent material and organic content. The matric potential of a soil can be measured using a tensiometer. It is advisable wherever practical to measure the matric potential of a given soil prior to calculating irrigation needs.

It is more important to irrigate transplanted trees frequently than to apply large volumes of water infrequently, as a single application of a large volume of water does not compensate for irrigating infrequently. Research has indicated that watering every other day with 4 to 8 litres of water for every 250mm of stem diameter just above the root flare might provide the most even soil moisture for roots.

Research has also indicated that in most climates, trees probably need to be watered about twice each week with 20L of water adequate to keep an 800mm diameter rootball well irrigated. The assessment of irrigation need can be assisted by the use of a simple soil moisture meter.

Sampling can be a useful exercise when large numbers of newly planted trees are being managed and irrigation needs are being assessed. It can take up to 4 to 5 months for enough roots to grow beyond the soil ball to take advantage of the water available in the surrounding soil following transplanting. During this period the tree is almost entirely dependent on the water contained in the soil ball. The period over which irrigation is required is likely to be at least two full growing seasons.

As the root system develops, the frequency of irrigation can be reduced. Root development can be between 1m and 4m each year depending on site conditions. Where it is possible for enlarged areas to be irrigated commensurate with root spread and development, a depth of 300mm is ideal. For soils with good water holding capacity this is the equivalent, per application, of 40 litre/$m^2$ of soil surface area.

Irrigation is best applied evenly across the surface area around the tree once the root system has developed beyond the root ball. Of the irrigation aids currently on the market, there are watering bags, which hold a known volume of water and deliver it to the soil surface over a period of time. Barcham have our own hydration bag available.

# 7.2 Post Planting Management and Maintenance

There are many manufactured irrigation systems which rely on water being applied through an entry point which remains above ground at the tree pit surface. These can be effective but tend to become clogged up and it is difficult to assess how much water has actually been applied at any one time. These are also dependent on being set at the correct level in the tree pit. If set too low water is delivered below the point at which it can be used by the tree.

Automatic irrigation systems can be useful but have to be monitored closely and carefully calibrated to ensure water being delivered when it is needed and not purely on a timed basis irrespective of prevalent weather conditions.

**Compaction:** The problems associated with compaction have already been discussed in the section 'Common Factors'. Compaction can be alleviated by the regular application of organic mulch which protects the surface of the soil, as well as adding organic material which can improve soil structure and texture. Where possible this should be maintained at a depth of 5-7.5cm. Regular tillage of the soil/substrate surface is useful.

In the urban environment the application of organic mulch can prove difficult and many surfaces have been used. It is beyond the scope of this document to discuss these surfaces here, but a useful analysis can be found on pages 68-69 of Trees in the Hard Landscape, A Guide to Delivery which is referenced elsewhere in this manual.

**Formative and Structural Pruning:** It has already been suggested that a young tree from the nursery is still developing. Very few branches on a 12-14cm girth tree will go on to become permanent scaffold branches which will age with the tree.

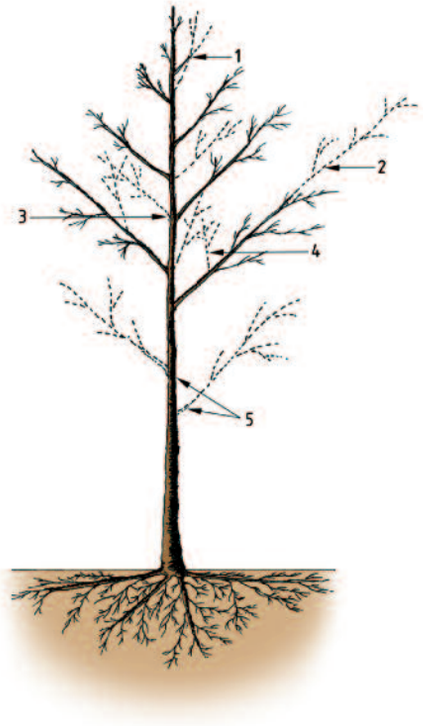
Regular formative and structural pruning post planting will produce a balanced and well-structured crown and many of the defects associated with trees in the urban landscape can be avoided by early years formative and structural pruning.

See 4 diagrams opposite.



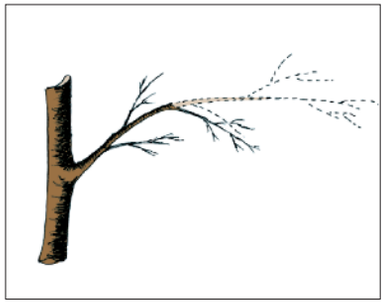


# Post Planting Management and Maintenance 7.3




1. *Co dominant leader to be removed*
2. *Over vigorous laterals to be subordinated to the main trunk.*
3. *Opposite branches to be removed*
4. *Upright growth into the crown to be removed*
5. *Lower branches from the nursery to be kept subordinated as they will not form part of the final scaffold branching system*

*Note: The above can only be a guide as species morphological habit vary and does not take account of feathered, multi-stems or other trained forms.*



*Lateral branches subordinated to be no more than 50% of the main trunk at the point of attachment*

*Included branch unions or weak forks to be pruned out*

*Co-dominant leaders to be pruned out or subordinated to the main leader*

# 7.4 Post Planting Management and Maintenance

**Support systems and protective furniture:** The management and maintenance of support systems and protective furniture is primarily about the timing of their removal and the realisation that their presence is only temporary.

See photographs below to appreciate some of the damage to young newly planted trees because they have been left in place for too long.

For further reading and information:

- *The Practical Science of Planting Trees: Gary Watson and E.B. Himelick. ISA publications.*
- *An Illustrated Guide to Pruning, Third Edition: Edward Gilman. Delmar, Cengage Learning.*
- *Applied Tree Biology: Andrew Hirons and Peter Thomas: Wiley Blackwell*
- *Trees and Design Action Group. Trees in the Hard Landscape A Guide for delivery.2014.*
- *BS 8545 Trees: From Nursery to Independence in the Landscape*





# 8.0 Conclusion

## FINAL THOUGHTS

The selection of trees for successful planting and longevity in the landscape is a complex process involving many decisions and potential decision makers. Hopefully this guide will be of use and aid that process.

I still believe the subject is a specialism and that expert advice should be sought throughout the decision-making process. It has to be remembered that, no matter how educated and thoughtful the choice of species is, poor planting technique coupled with poor and inadequate post-planting maintenance will inevitably lead to failure.

**Contact**
If you would like to discuss the subject in greater detail,
then please contact the Barcham team: info@barchamtrees.co.uk

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The Tree Specialists



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