Specification guide 2: semi-mature transplants

Caroline Swann and *Peter Thoday* look at how large stock is produced on the nursery, and how best to prepare the site to ensure successful establishment

all photographs: Hillier Nurseries

↑ **Container-grown pines at Hillier Nurseries: large conifers are easier to establish when container grown**

The desire to create an instant landscape is nothing new — for centuries, great private gardens and parkland landscapes have been created world-wide using semi-mature plant material. Illustrations of 18th and 19th century large tree transplanting show how impressively big specimens were moved, some even on purpose-designed and built horse-drawn carts. Curiously the 20th century saw fewer and smaller semi-mature specimens on the move, although the technique of 'preparing' trees and root-balling them for short journeys, often within the same property, was enthusiastically developed. Contemporary reports from those days remind us not only of the massive amount of work that went into both ends of this operation but also how very successful it was.

It would seem that the real difficulty was not so much a biological one as a logistical one, and it may be that solving the lifting and transporting of these large specimens has been the key to their increased use in recent times. The myth that large tree and shrub transplants struggle to establish can be largely shattered if container-grown, or well-prepared regularly nursery moved root-balled or bare-rooted specimens, are specified and receive the necessary on site care. Currently the instant impact landscapes that are associated with large specimen transplanting tend to be more associated with commercial activities, such as superstores and business parks, than with the great estates where the story started. Today we have every reason for viewing large tree transplanting with confidence. Nevertheless our present revival of these techniques got away to a very slow and uncertain start with a high percentage of losses, with the majority of those that survived showing extremely poor growth for many years.

The blame for these disappointments can fairly be shared by everyone concerned — the nurseries, the transporters, those working on the planting site, those who were responsible for post-planting maintenance and behind it all, designers and specifiers who failed to identify the really critical issues that made all the difference between success and failure. In a way this blame can be passed off as a case of over-optimism — a hope that taking short-cuts didn't reduce the chances of success. This is now behind us, and the last few decades have removed the ignorance and replaced it with an understanding that justifiably gives confidence. Of course, this understanding also removes the excuse for most failures!

Today we classify large transplants under three headings: bare root, root-ball and container grown. All three techniques are successfully practised ,and indeed there are those within the nursery industry who would say there is little to choose between them if they were faced with transplanting a specimen within their own property. This having been said, certain genera are easier to establish when container-grown — for example *Betula*, *Fagus*, *Quercus* and *Pinus*. For the majority it comes back to the point that care, practicality and logistics are the governing factors.

Bare root transplants

We now recognise that bare root transplants are successful if they are able to retain some 25 per cent or more of their root system. Success depends on that root system being kept alive, reasonably undamaged and moist throughout the whole of the transplant procedure, and the trees given the appropriate conditions, care and attention both at the time of replanting and during the essential subsequent

↑ An 'air pot' opened up to show root growth

maintenance. These requirements are fairly easy to achieve within a nursery or on the most favourable landscape sites, but only during the window of opportunity presented by the dormant season. Unfortunately most contemporary urban planting sites are not so favourable, and it is extremely difficult to meet the required level and conditions of care.

When it is appropriate to use bare root transplants, procedures need differ little from those used for root-balled or containerised specimens. The most critical tasks are to position the remaining roots, and when backfilling to work the soil between them. This requires friable soil to be added 'little and often', not dumped as a wet lump squashing down the exposed roots. Irrigation in the form of 'watering in' should follow immediately.

Bare root and root-balled trees are prepared by specialist nurseries who regularly transplant and prune them to produce a good quality tree whose canopy and root system are in balance. These procedures make sure that the root ball contains not only the proximal portion of all the major roots, but sufficient finer root to absorb water and sustain the plant in the first few weeks or months after transplanting. Immediately on lifting from the nursery, root-balls are usually protected by being encased in a non-galvanised wire netting mesh whose essential role is to hold and keep the soil in place so that the finer roots can continue to have the intimate contact with the soil particles which is essential for efficient water uptake. Inside this protective mesh, the root balls are often covered, ideally in hessian or plastic or simply covered with damp straw if that is considered sufficient packing for the circumstance. Whatever the cover, it is essential to keep the soil ball moist from the time it is lifted until the time it is planted.

Most root-balled transplants, other than those packed in plastic for transport, are wrapped in degradable materials. Typically these are thin, non-galvanised wire netting and hessian. These materials should be left on the root ball when planted. However, one must ensure that there are no constricting materials left around the base of the trunk.

Recent work in Europe suggests that deep planting is disadvantageous and may be the cause of tree losses. Contractors often do this to achieve greater stability, however, it would now seem correct to plant at precisely the same level as that previously found in the nursery. Techniques of anchorage, whether above or below ground, that avoid damage to the root ball are preferable to driving stakes through the soil mass.

↑ This specimen has had the growing medium washed out to show the fibrous root growth

Container-grown trees

Whereas bare-root and root-balled trees have been available for many years, containerised semi-mature specimens are a relatively new product. Their attraction is their year round availability and the probability that they will succeed in many cases somewhat better than the other two forms of transplant if correctly managed.

Today and for the foreseeable future they are likely to cost more to produce and therefore to buy. Fewer types of tree and shrub are available as container-grown specimens, but the range increases every year. However most producers have limited stocks of each, so potential customers should check availability and reserve stock.

The specimens used to produce container-grown trees are selected from the nursery field for containerising and are potted into the container either as bare root or root-balled specimens according to the species, their size and time of year. The trees then require one growing season to become established and produce new roots throughout the compost in the container. After one growing season most specimens are ready for planting, having re-established a functioning root system. In recent years this process has been so well developed that the trees not only produce an excellent amount of new root in that season but also healthy foliage and considerable extension growth. It is this combination of a vigorous root system, well-developed buds and a high carbohydrate content resulting from the photosynthesis achieved during that year that makes these transplants potentially so successful.

Developments in containers

Trees across Europe may be grown in many types of container. However, after much testing at Hillier Nurseries, most container-grown trees are now produced in air-pots. This method of containerisation actually prunes back the roots as they attempt to grow through the perforations into the surrounding air. The root tip withers, but behind it side roots develop, thus producing fibrous root growth. The net result of all this activity is a mass of fibrous root at the edges of the circular containers that will quickly help the tree to become established once planted out on site.

The use of bare-root and root-balled specimens is best restricted to the dormant season. In contrast well grown, container produced trees and shrubs can be moved at any time without suffering from the act of transplanting — indeed they should immediately benefit from it. However, site conditions

Size of containers

The size of the container that the tree is grown in depends on the size of the tree. The exact pot size will vary between nurseries, but generally:

Trees 8-10 cm to 10-12 cm girth	**45 litre pot**
Trees 12-14 cm to 18-20 cm girth	**80 litre pot**
Trees 20-25 cm to 25-30 cm girth	**200 litre pot**
Trees 30-35 cm girth	**300 litre pot**
Trees above 30-35 cm girth	**300 litre pot**
Up to 60-70 cm girth	**1000 litre pot**

and husbandry inputs are more demanding during the growing season. If these factors are overlooked at that time of year, the plants will suffer more dramatic and catastrophic effects

Transporting large transplants

No doubt those who move semi-mature trees regard all three types — bare root, root ball and container-grown — as awkward loads. However, in recent years considerable ingenuity in the specialist nurseries has produced efficient lifting and packing methods that should ensure that the tree arrives on site in good condition. Those receiving such trees should pay particular attention to any damage caused to the main trunk and branches. The odd twig broken is of no consequence compared with damage to the bark.

Unloading the tree should receive the same care and attention that the loading was given in the nursery. Semi-mature transplant storage on site should be kept to a minimum. With all three categories it is permissible, for short periods, to store them lying down and is probably preferable to having them in exposed positions where they are likely to be blown over and their canopies damaged. There is a risk of the trees drying out throughout the storage period and although this seems an obvious candidate for attention, it is surprising how many trees die through root desiccation between arrival on site and planting.

The planting operation

Work should start well in advance of 'the final act'. The first concern should be that the site selected is well drained

↑ Loading container-grown trees during the summer requires special treatment, with the canopy carefully tied, the root-ball protected and the stem wrapped in a cardboard sleeve to prevent rubbing which may scar the stem during transit

or, in many cases, can be made to drain satisfactorily. A common error is to attempt to assess the soil drainage characteristic by digging a hole and finding out how moist the soil is at various points down the profile. The challenge is to be able to read the evidence accurately. Rather dry soils may suggest good drainage, but it is quite possible that the real reason for such dry samples is that the soil is so compact that water cannot enter; excavating a hole in such compacted soils is likely to produce a pond rather than a satisfactory planting pit. Any test pit should be filled with water and the speed of its drainage noted to ensure that the pits cannot hold water.

To make certain that the pits cannot hold water, badly-drained sites will need some system of pipes or French drains leading to a functioning outfall. The second consideration is to ensure that the roots can grow out from their planting pit into the surrounding soil. Clearly, to achieve this the soil must be root penetrable. If compaction has occurred soil ripping is usually recommended but this may not be possible on some sites, in which case resort to digging. In this respect the sides of the planting pit are far more important than the bottom.

→ *Size of hole*

Under ideal garden conditions, a tree is normally being transplanted into an undisturbed soil profile. In this situation, the hole need be only large enough to hold the roots or root-ball and allow sufficient room for soil to be back-filled and firmed around it.

When, as is more often the case, semi-mature trees and shrubs are used on development sites, it is extremely beneficial to make the hole considerably larger than the root spread or root ball. Ideally the hole should be some 2m in diameter so that a significant amount of good quality topsoil back fill can be placed around the transplant. This produces the right conditions for roots to grow outwards, thereby quickly increasing the stability of the tree and the size of the moisture gathering root territory.

→ *Staking the tree*

On most sites, it is necessary to stake the kinds of tree and even large shrub being considered in this guide (see

↑ **Trees positioned onto the loading plate of the tree mover ready for loading at Hillier Nurseries**

Plant User, April 1990 for more advice). Not only is it important to prevent the trees blowing over but also to ensure that there is no movement capable of damaging developing roots. There is little to choose between staking, guying and underground methods providing a well-proven technique and suitably strong and durable materials are used. Some very effective methods have been patented.

→ *Irrigation*

This is by far the most important factor in the whole procedure (see *Plant User*, October 2000). Nursery producers have become extremely skilled in understanding the moisture requirements of large specimens both in the critical stage immediately after transplanting when this occurs as part of the production schedule and, in the case of container-grown specimens, as part of their day-to-day husbandry. When planted on site, a specimen should have sufficient functioning roots to sustain it. This in spite of the transpiration from its leaves, and the need to support its production of new roots that will both re-establish the correct root:shoot ratio and spread out to tap the moisture held in a large volume of soil. Until this happens the only moisture available is that held immediately around the transplant's roots. Regardless of whether the specimen is bare root, root-balled or container-grown, that volume is rarely above 0.5m which, even when at field capacity, is likely to hold no more than 150 litres. In the growing season that amount of water will last a leafy 18-20cm girth transplant well under a week.

Perhaps such a need for irrigation is best understood by recognising that many nurseries irrigate their container grown semi-mature transplants on a daily basis. Most semi-mature transplant failures can be traced back to a critical water shortage. Instructions to contractors to water up to six times in the first year are clearly leaving life and death in the hands of the local weather conditions for the coming season. Although semi-mature transplanting can take place during the summer it should not be attempted without irrigation having been assured. Such irrigation can be 'plumbed in' and operated either automatically or manually. At the other extreme, watering from hose pipe or bowser is perfectly satisfactory if carried out as and when required. The first approach commits the scheme to a high capital cost, the second to a high maintenance cost. Whichever system is used, it is essential to get water into the root-ball and not have it run ineffectively round the sides. This is best achieved by drip application.

Transplanting during the dormant season reduces the need to irrigate significantly. However, a dry period of only some two to three weeks at the beginning of the subsequent growing season often proves fatal unless irrigation is applied. The risk is not simply a matter of killing the tree or shrub but almost equally disastrous for the design intent, throwing the specimen into check whereby extension growth virtually stops for many years. As this is typically accompanied by an equal response below ground it is evident that the transplant remain vulnerable for many years.

Although the addition of nutrients is far less critical than the correct water balance in the soil, additional fertiliser in the first few years will improve root, leaf and shoot growth on development sites with little or no topsoil. A typical application would be 200g of 20:10:10 NPK, per specimen per annum applied in late February.

Conclusion

Container grown trees can be planted all year round and are therefore very useful in the commercial world, providing instant landscape settings for superstores, business parks and the like, whose development programme is unlikely to be ruled by the constraints of the traditional planting season (November until the end of March in the UK). Due to this flexibility container grown trees are becoming increasingly popular. They do have some disadvantages. They are more expensive than bare root and root balled trees, and only a limited range of trees will be available as container grown, as the bulk of trees are still field grown and therefore available bare root or root balled. Check availability with the nursery before specifying and reserve stock.

Creating a functional, successful and elegant landscape on site can be fraught with problems. However, it must also be one of the most satisfying and inspiring things to achieve. When large transplants are used work on the nursery and on site are equally important to both the instant effect and the long term success. ■

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