

Buying quality nursery stock – a consumer perspective[©]

B. Cadwallader^a

Cadwallader Tree Consultancy, 33 Cropp Place, Richmond 7020, New Zealand.

INTRODUCTION

It goes without saying that trees can be produced at variable levels of quality and it is one of the challenges for consumers in today's marketplace to be able to pick the winners. Unfortunately, many consumers don't know what a good quality tree is and that is part of the problem. They rely on the market to produce good quality trees for them but this requires producers to know what a good quality tree is.



Figure 1. These two trees would have cost the buyer the same amount of money. The one on the left has good form and good trunk taper, but the one on the right has poor structure and only lasted 10 years.

As trees grow, little problems can develop into really big problems. Figure 2 shows what happens when root-bound stock gets planted in field. Poor quality tree stock like this is unlikely to grow beyond 10-20 years.



Figure 2. This is what happens after a few years when root-bound trees are planted out into the landscape. Top right image credit, Dr. Ed Gilman, University of Florida. Used with permission.

^aE-mail: brad.cadwallader@paradise.net.nz

If consumers make good choices when buying trees they will be making a good investment; their trees will live longer, perform well, provide a very good environmental contribution, be generally low maintenance, and generally be safer trees. Unfortunately, finding trees to fit this bill can be challenge as a lot much of the tree stock I see produced in New Zealand is simply not fit for purpose.

So when a consumer goes to a local nursery to look for a tree, or browses through a catalogue, there are many factors to consider when purchasing container-grown trees. Things we will consider here are root collar location, problems caused by root depth, and issues with branch structure.

FACTORS TO CONSIDER WHEN PURCHASING CONTAINER-GROWN TREES

Correctly locating the root collar

First, let's just define what a root collar is and where it should be located in the grow bag. The root collar should be above the soil line and the uppermost root needs to be within 50 mm of the top of the container or bag. Unfortunately, the majority of root collars get buried during production as trees are bagged on to larger grades. Buried root collars encourage roots to grow up into the media on top of the main root system and invariably girdle the main stem.

As a consequence of this, when trees are planted out into the landscape they perform poorly because they struggle with soil aeration. They do all right in the nursery because the nursery is really a holiday resort for trees – they're being fed and watered and get adequate oxygen. But as soon as they are planted out they struggle when their roots are situated below grade. Small girdling roots can also develop to become a serious problem.

What is a high quality root ball?

A high quality root ball is where the root collar is above grade and the point where the topmost root emerges from the trunk is within 50 mm of the soil surface such as those shown in Figure 3. In contrast, a poor quality root ball is where the root collar is buried, either by being planted too deep in the container or excess soil is placed on top as shown in Figure 4.

When trees are container-grown, containers are often topped-up with extra soil or medium as the trees settle lower. As trees are potted-on into bigger containers, this cycle can be repeated. This results in roots growing up into the medium above the root system and encircling the stem.

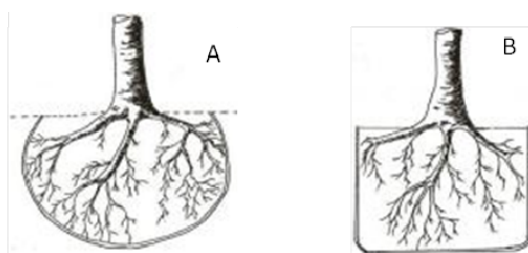


Figure 3. What a high quality rootball should look like with the top most root emerging no more than 50 mm from the soil surface. From BS 8545: 2014 Trees: from nursery to independence in the landscape – Recommendations. Drawings courtesy of Keith Sacre.



Figure 4. Poor quality root balls where the top most root and the root flare are buried inside the root ball.

Basically, trees such as that shown in Figure 5 have been placed in the bottom of the bags, then medium put on top of them two or three times in the course of their production so they ended up nearly in the bottom 25% of the bags. Trees like this should not be planted.



Figure 5. A very poor quality tree where the root collar and the original uppermost root were found to be in the lower 50% of the bag.

The problems that we see with trees on sale in the marketplace like those in Figures 5 and 6 could easily be avoided with education and can simply be addressed during production as they can't be undone once established. In discussions I've had with some nurseries I'm surprised that many don't seem to even know about these issues. I learnt about these problems more than 20 years ago and it is unfortunate to see how widespread they still are.

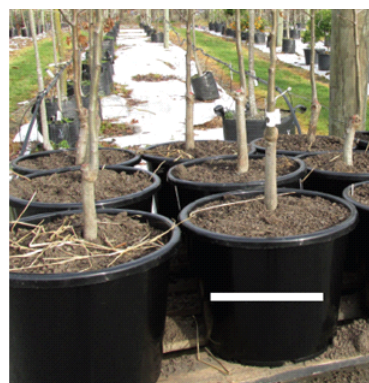


Figure 6. Newly potted stock in a wholesale nursery. The white line indicates where the root collar is – in the bottom half of the container.

Root defects have a significant impact on landscape performance and tree stability. Basically, a tree needs to have really good structural support to take the wind load it will

receive to its canopy as it grows. Trees with poor root structure are not going to be able to produce good, radiating, stabilising roots because they had well-established girdling or circling roots at the time of planting.

Trees with root systems like that in Figure 7 should not be planted. This tree had a price tag on it of \$NZ 225 and it's really quite a defective tree. Unfortunately, in the line of trees where it was situated, there were lots of gaps where people had been buying these trees and they will have been planted out in the landscape.



Figure 7. An example of a poor quality tree with roots encircling the bag which was so tight, the stitching was pulling apart. Lichen on the stem indicates also the tree had been in the nursery for several years.

I have seen the results of much of this type of plant material over the past 20 or so years. People ask me to come along and tell them why their tree has died or why it keeps falling over. Why do we need to keep staking our trees? Why do we need to keep staking our trees? In most instances I find the problem appears to relate to defective root systems created during production. So, right from the start these trees were set up for failure.

Root defects are one of the leading causes of early tree mortality. Without a really good, well-developed root system a tree just can't perform in the landscape. Inferior trees will be lucky to reach 10 to 20 years of age when they should last 80 to 100 years or more. Clearly when plant material like this is sold it is just not fit for purpose.

Plants people may ask, "oh, when you buy a tree like this, can't you just butterfly the root ball or cut the roots on the outside and all will be well?" But root ball defects can occur at all stages of production and defects on main roots close to the trunk are difficult to correct. In Figure 8 below, you can see the different bag sizes used as the tree was bagged up.

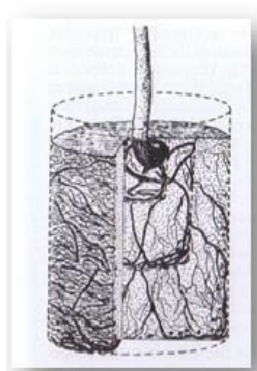


Figure 8. Diagram showing how roots have grown as a tree has been bagged up into different sizes. From: Harris et al., 2004.

You can deal with the ones on the outside of the bag by cutting these roots but many

root defects aren't very visible to the purchaser when they're buying their trees. Trees that have been recently bagged up will look ok but unfortunately can have hidden defects well within the root ball that may have started at very small grades and lead to premature death (Figure 7).

It is a real challenge to produce container-grown trees without root defects. People all over the world have put a lot of effort into trying to overcome these challenges. Many different bags, containers and methods have been tried. There are copper-impregnated bags which are designed to prune roots when they reach the bag sides; there are containers with corrugated sides to stop circling roots and others designed to air-prune roots. So it's obviously a recognised problem.



Figure 9. This tree got to 25 years old and then died. It is not hard to see why.

Branch and stem structure

Consumers come along and pick through the stock shown in Figure 10, get the best of the worst and take them away. The ones that are left sit there and sit there, the price gets dropped, so they then go out the door as well and will end up failing in the landscape. This stuff is really just complete rubbish.



Figure 10. Examples of poor quality trees found in a big store retail nursery.

Trees of lesser quality have two or more leaders. Ideally a good tree should have one central stem extending to the top of the canopy and this sort of thing is the easiest to get right in a nursery. All you need is for someone to go out and do a bit of pruning (Figures 11 and 12).

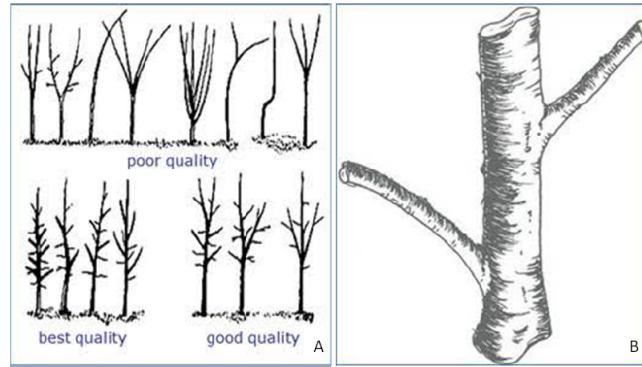


Figure 11. Trees of poor and good quality (A); Drawings used with permission from Dr. Ed Gilman, University of Florida. Branches need to be about 50% of the diameter of the main stem, avoiding co-dominant stems of similar diameter (B); From BS 8545:2014 Trees: from nursery to independence in the landscape – Recommendations. Drawings courtesy of Keith Sacre.



Figure 12. Examples of good and poor quality trees and how they should look. Used with permission from Dr. Ed Gilman, University of Florida.

Good quality trees need to have main branches that are not touching each other or the main trunk. Branches on large trees should be about 450 mm apart and have nice radial spacing while the main branches on smaller trees should be about 150 mm apart. Ideally, branches need to be about 50% of the diameter of the main stem, avoiding co-dominant stems such as that illustrated in Figures 12 and 13.



Figure 13. An example of a poor quality tree with co-dominant stems.

Co-dominant stems

Many poor-quality trees look like the example in Figure 10 illustrating a tree with co-dominant stems, major branches are touching, there are v-shaped crotches, lots of included bark, so all in all a very weak branch structure. It is really difficult to correct this. In fact this tree was heavily pruned after it was purchased and that's what could be made out of it after it was pruned. Basically, the wind did the deed and the tree failed in the end. These branch unions just failed so the tree had to be removed.

Stem taper

Trees need to receive a wind load to enable them to start developing good taper and become wind-firm. Staking trees needs to be very well managed in order to produce trees with good taper. Trees will not be self-supporting (develop good taper) if staked throughout production.

Trees with the same stem diameter at the soil line as they do further up the stem will have real difficulty in performing in the wind when they are planted out in the landscape. Trees with well-developed taper are what consumers should be looking for when selecting trees. Figure 14 illustrates good and poor stem taper.

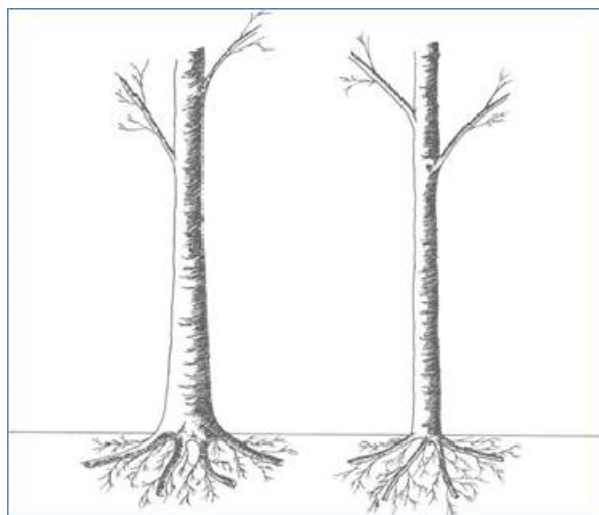


Figure 14. Tree to the left has well-developed stem taper; the one on the right has poorly-developed stem taper. From BS 8545:2014 Trees: from nursery to independence in the landscape – Recommendations. Drawings courtesy of Keith Sacre.

Pin oaks are a classic example you often see – big floppy things, very narrow-stemmed at ground level and very, very tall because they’ve been staked or held against a wire system or grown too close together.

It’s very difficult to hold these trees up in the landscape. You have to continue to stake them, further inhibiting the development of taper as movement is restricted.

Often a staked tree in the landscape gets fatter where it flexes above the stake when it really needs to build a good taper at ground level. Ideally, trees should have good height-to-stem girth ratio such as that illustrated in Figure 15.

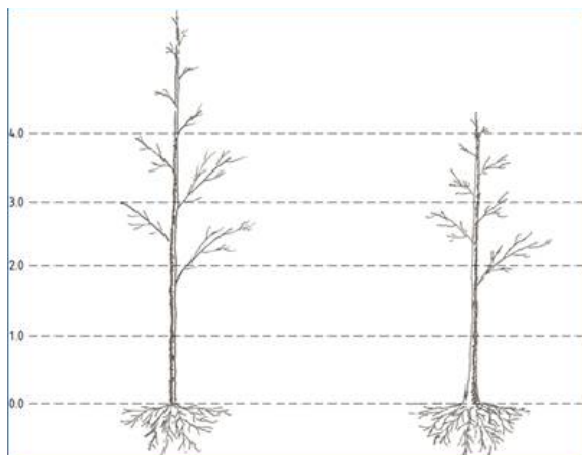


Figure 15. Tree to the left has poor height to stem girth ratio; the one on the right has good height to stem girth ratio. From BS 8545: 2014 Trees: from nursery to independence in the landscape — Recommendations. Drawings courtesy of Keith Sacre.

Clearly the tree shown in Figure 16 has had structural issues from an early stage that could have been corrected in the nursery or have been avoided by the consumer. Small poor quality trees can become big expensive mistakes. It now presents a considerable challenge for anyone managing it.



Figure 16. Small, poor quality trees become big expensive mistakes.

And where trees also have poor root systems such as that shown in Figure 17 – well, we've had lots of wind events in recent years and these storms provide a good test and indicator of the quality of trees in our landscapes.



Figure 17. A common sight after wind events

Of course there are the big trees that fail for various other reasons but there are hundreds and hundreds of small trees falling over as well. On close inspection, many are seen to have bad root systems. The problem is they had well established circling or kinked roots when placed into the landscape and they've just got no ability to produce any stabilising roots and take those peak loads when storm events come along.

So maybe the time has come for nursery standards in New Zealand to address some of these issues and to offer some confidence to consumers? I know Australia has been working hard over quite a few years to get theirs going and I think it's in the final draft stage at the moment. The British have got a fantastic document called BS 8545 Trees: from Nursery to Independence in the Landscape. It's quite an outstanding document.

For consumers to be able to grow good trees in the landscape, they need a supply of good trees. It would obviously help if consumers knew what a good tree is but unfortunately they don't so they will continue to keep buying what the nursery industry serves up to them. There are some good people out there trying to do a good job and produce good trees, but unfortunately they are a minority.

At the moment the market appears to be very producer-driven in New Zealand. The stuff just gets served up and it goes out the door.

Maybe if consumers knew more about what a good quality tree is, the pressure could be put on producers to deliver. Either that or the industry has got to start doing something to direct change.

Obviously, we need more nurseries to know what a good quality tree is and obviously there's a bit of education needed there. No one really sets out to produce a poor quality tree but there appears to be a fundamental lack of understanding of how trees grow.

In conversations I've had with growers, they've not been aware that the root flare should be at the top of the bag, and they didn't understand that when it wasn't, that this was actually a serious problem. So I don't know what sort of message that sends.

Why growers of tree material wouldn't know this sort of information is surprising when there is so much published literature on the subject of nursery quality. Maybe it's an education thing or that the market needs to speak louder.

The bottom line is that poor quality trees, especially those that have intact circling roots, are a total waste of time and there's no place for them in the landscape. They just become a liability and a bad illustration of what a decent tree should be. Trees are getting a

really bad knock for falling over in the wind and a lot of it is because they're flawed.

Trees are incredibly robust structures but unfortunately if they've got flaws then they don't perform as they should.

Retailers are consumers too. They need to know what a good tree is because at the end of the day what they're doing with a tree they stock is putting their brand on it and selling it. So they're the ones that will get the flack if it fails. Retailers need to pay a bit of attention to this issue as well and demand higher quality trees and support the growers producing them.

And I think the New Zealand nursery industry really does need to set some standards. I know you've got a lot of other challenges at the moment but this is one that I think you could put alongside the FMS (Farm Management System) program that you're adopting.

Given that Australia has done a lot of the hard work on a Nursery Standard already, it wouldn't be very difficult for New Zealand growers to take some lead from this and other international standards.

How it should be done

And just to prove that it can be done – the guys at Trees Impact are a very impressive crowd in Australia, that are producing the most amazing tree stock as shown in Figure 18.



Figure 18. Some of the impressive trees grown at Trees Impact, New South Wales, Australia. Image courtesy of Trees Impact.

How they can produce container-grown trees with root systems like the one shown is pretty astounding. Every single one of those roots shown goes right back to the main stem. There are no girdling or circling roots in that root ball and that's proof that it can be done.

If there is anyone in New Zealand producing trees like this, then there are a tonne of consumers out there that would really like to know about you.

Literature cited

Harris, R.W., Clark, J.R., and Matheny, N.P. (2004). *Arboriculture. Integrated Management of Landscape Trees, Shrubs and Vines*, 4th ed. (Upper Saddle River, N.J.: Prentice Hall).