



Getting Ready to Re-pot is an introduction to the issues and approaches that we use when re-potting our bonsai. It is not intended to be a definitive how-to, but to provide information and support as the bonsai artist develops their understanding of the trees in their collection. We all have subtle variations in our own microclimate, watering habits, feeding regime, soil mix, etc., which affect the growth of our trees and their development needs.

Patience, observation and practice are, and will remain, the best way of developing your bonsai. Discussion, reading and observing others simply provide insight and alternatives for you to consider.

A bonsai caution: There are so many approaches and practices that it is important you develop your understanding and approach with care. Follow one strategy at a time to start with. If you want to experiment, choose one tree and use the 'alternative' approach until you understand the impact it has on your trees. At this point you either adapt, adopt or abandon the alternative...

Adopting all of the techniques on a single tree can lead to disaster, as there are occasions when the different approaches conflict with each other and the result is often dead or near-dead trees.

1. Why

RE-POTTING IS INVASIVE AND DISRUPTIVE TO A BONSAI'S DEVELOPMENT, SO WHY DO IT?

Any pot-grown plant is confined, and will ultimately adapt to the environment that it is growing in. The re-potting process is part of how we manipulate the growth and development of our bonsai. Re-potting is our opportunity to develop the root system in a bonsai fashion, to prevent the tree from strangling itself and ensuring that the soil is free-draining.

Let's look at each of these points in turn.

1.1 Manipulate the growth and development...



Constricting a tree in a pot and starving it of sustenance and water is not the approach that we normally use in developing our bonsai. The risk of failure, the input of time and experience, as well as the continuing maintenance, make this approach all but impractical. There are a very small number of bonsai artists that are able to develop their trees using this "sour" approach but they are dedicated full-time to their trees.

The more usual approach—the "sweet" way—is that we provide an abundance of sustenance, light, water, etc. and encourage our bonsai to grow. This leads to an excess of growth in the crown; green growth which we are then able to prune and

shape to the profile we wish for our bonsai. Re-potting is the opportunity that we use to do the same to the root system.

If we didn't re-pot, the tree would grow roots and fill the pot to the exclusion of soil, eventually strangling the tree.

1.2 Develop the root system in a bonsai fashion...

In the same way that we develop the bonsai's crown, we also seek to manipulate the bonsai's roots. While the crown development is largely aesthetic, the roots serve four purposes and we want to impose an aesthetic as well.

The functions of roots are to:-

- Support – In the ground the tree needs support to stay upright against gravity, wind and other forces. To achieve this, it has two types of roots: the tap root and lateral roots. These are thick heavy roots that anchor the tree against the forces trying to tip it over.



- Absorb nutrients – The third type of roots are the feeding roots. These are the fine roots which are spread throughout the tree's root network. Feeding roots are vital to a tree's development; they absorb the nutrients that allow the tree to grow and make up the building blocks that work with the photosynthesis to grow the tree.
- Absorb water – The root system absorbs water, providing the hydraulic pressure to drive the transportation of the nutrients around the tree and making up the water lost by the crown in respiration.
- Breathe – Often forgotten, but vital for a tree, is that the roots also breathe, they absorb oxygen etc. This absorption of oxygen is not at the same level or as important as the respiration in the crown, but it is still significant.



And then we look at the aesthetics. We want surface roots—*nebari*—but we don't need a lot of the lateral roots and have no depth in a pot for the tap root. We do, however, want an abundance of nutrients, water and gases to be absorbed and therefore need plenty of feeding roots. Careful root pruning moves us towards this situation and this requires re-potting.

1.3 Ensure the soil is free draining.

Over time the soil in our bonsai pot degrades. This is caused by the tree producing roots, the washing of fertiliser and other organic detritus into the soil as we water, and the general breakdown of the original soil components. All of these are inevitable, and lead to the degrading of a root environment which was optimised at planting. The soil becomes less porous, less free draining, and gases diffuse through it more slowly. As we move from optimal to sub-optimal, our soil becomes more water-retentive, anaerobic and promotes a wet rot-





promoting environment around our bonsai's roots. We re-pot to move from a deteriorating soil environment towards one which optimises our bonsai's health.

2. When

WHEN SHOULD I RE-POT MY BONSAI FOR BEST RESULTS?

This is always a difficult question with a variety of answers: there is a huge range of options and sub-text to consider such as general health, variety, vigour, seasonal variation, broken pots, etc...

- **Emergency** – Sometimes we simply don't have a choice. Pots broken, the tree (particularly with Satsuki Azaleas) has a section in poor health, the tree is lifting itself out of the pot, the tree was knocked out of the pot, etc. In these circumstances, generally we re-pot with the minimum of intervention with the tree's root system. The exception being something like the Satsuki Azalea, where poor health in a section of the tree is an indicator of poor root condition in the reciprocal area of the tree. Eradication of the rot quickly and completely is essential for the tree.
- **Optimal** – In general, the optimal time for a deciduous tree to be re-potted is just as it starts into regrowth after a period of dormancy. For a coniferous tree, the early spring or late summer as the tree enters a period of regrowth. Spring is obvious here, but the late summer is peculiar. Coniferous trees 'shut down' under high as well as low temperatures, therefore after a hot summer as autumn approaches, the tree starts to grow again—hence the late summer option. For flowering trees, tradition is that you re-pot after flowering; however there is also a school of thought that says early spring is better. The spring re-potting risks some flowers, the after-flowering re-pot risks root damage to tender roots through the winter. Tropical trees grow continuously and there is no perfect time; spring and early summer give the trees the warmest days, longest daylight, and is therefore the preferred time. This is the shortest route to develop the bonsai as we achieve the maximum benefit in the shortest time.

Already a variety of answers and we have not even started to look at species specific requirements!

- **I've got time** – Within limits and with the right aftercare, this approach can work although you might take two or three seasons to achieve what would be possible in one if re-potting was undertaken optimally.

If only there were a single right answer...

WELL HOW DO I TELL IF MY BONSAI NEEDS RE-POTTING?

There are signs that a tree gives us, that it is ready for re-potting—the tree will tell you.

It won't take water. It's been 1, 2, 3, x years. It sheds water. And so it goes on... some esoteric divination seems to be the primary requirement when you talk to a bonsai artist.

All of these points are true and none of them have any specific meaning, so we need to understand what triggers a re-pot.



So when observing your tree and looking for the signals that it is time to re-pot, we might observe:-

1. The bonsai is difficult to water.
2. The tree doesn't dry as fast in the summer.
3. The bonsai is growing slower, less well than last year.
4. The soil is rock solid and shedding water.
5. The bonsai is going "yellow".
6. The bonsai is not as glossy, bright as normal.
7. The bonsai is climbing out of the pot on a bed of roots.
8. The bonsai is dropping leaves out of season and they are losing colour, e.g. summer.
9. The bonsai is dropping its leaves early in the autumn.
10. The bonsai is not setting leaf or they remain unusually small.
11. The bonsai is dying back in the winter.
12. Heavy moss and liverwort can indicate a heavy soil.

These are but a few examples of how a bonsai might indicate that it is time to re-pot. There are many others, and some are easier to understand and identify than others. You simply have to become observant and understanding of your trees and their nature. To complicate life, some of these signals can also mean that the tree is being attacked by any variety of pests or has submitted to a disease.

There is no fixed timetable; magazines and books suggest every year, every two years, etc. and this simply is too formulaic. Re-potting is an intervention that disrupts normal growth, and should only be undertaken as and when necessary; a starter tree may require re-potting every year to allow us to establish bonsai roots. As the tree matures, and the interventions move from developing the *nebari* and roots to maintaining a healthy root environment, the period between re-pots will extend.

Understanding this is one of the most exasperating skills we all have to develop. There is no right answer, just a variety of them. The better we become at reading our trees' signals, the better we will become at optimising our trees' growth potential.

If you are unfamiliar with a tree or it is new to your collection, generally observing and maintaining the tree for a year or two before significant work will lead to fewer errors and better results. In general, this means that I prefer to allow a new tree to grow accustomed to my practice and microclimate before I start heavy interventions like re-potting. The exception here being, where I know and have access to the previous owner to discuss where they were in developing my tree.

3. What

WHAT DO I NEED TO RE-POT?

It will not surprise you that there is not a single or simple answer. Here are a few thoughts...

- Starting off with the basics, you will need space to work.
- You will need enough of your bonsai soil, mixed and sieved as appropriate, for the tree you are re-potting.
- You will need mesh to cover the drainage holes of the pot.
- You will need bonsai wire to (a) tie the tree in the pot, and (b) hold the mesh over the drainage holes. 1.5mm to 2.0mm should be sufficient, for smaller trees 1.0mm can occasionally be useful.

Tool wise I would suggest:-

Soil Preparation

- Sieves
- Holding Container (Bucket)

Tree Removal

- Waste Container (Bucket)
- Turntable
- Wire Cutters
- Pot Saw
- Pot Hook
- Chop Sticks
- Steel Pick

Root Pruning

- Root Hook
- Root Rake
- Spray Bottle
- Root Scissors
- Branch Cutter
- Knob Cutter
- Scissors

Re-potting

- Soil Scoop
- Chop Sticks
- Tamping Trowel
- Rubber Mallet
- Jin Pliers
- Watering can/Hose



Most of these will be in a bonsai artist's tool kit once they pass through the initial novice gate. Those that you don't have can generally be adapted from tools around the house.

In addition, you will need to have your moss available to dress the pot when finished; I use the dry sphagnum which has been chopped to a fine consistency in a food processor. This layer of moss slows the drying of the top surface, and evens out the growing opportunity for roots in our pot, by keeping the soil evenly humid.

Now for a quick look at soil...

Our trees grow in an artificial environment and the boundaries are defined by the pot we put them in. The soil we use therefore needs to support the development of our trees in this artificial miniature environment. We develop our trees' root system through pruning, to be dominated by feeding roots and a small *nebari* group. The soil is the environment where we develop these roots.

It is impossible to fully explore soil in a few words, so this is but a brief review. Soils are part science and part art; none of this is exact and you need to understand the impact of your soil mix choices. Myths abound more in this area than any other, and reality is often shrouded under the cloak of proprietary secrecy or artistic mystery.



Reducing soil down to the fundamental—it needs to support the root system, hold some nutrients, hold sufficient moisture, allow drainage and gas diffusion, and create a habitat that allows the flora and fauna that support the growth of our tree to thrive. There; it's simple!

But we only have a cupful of whatever to do all of this. And we bake it in the summer. Then freeze it in the winter. And still want it to last decades....

Some of the technical factors that we need to consider, but do not always have the information available, or the knowledge to understand, are:-

- Cation exchange capacity
- Soil structure
- Durability
- Availability
- Water retention
- Soil miles
- Environmental impact
- Specific Heat
- Available water
- Permanent wilting point
- Heat retention
- Field capacity
- Capillary rise
- Organic Content
- Sandy/Clay Soil
- Drainage layers
- Nutrient retention
- Structural integrity

This is, in simple terms, summarised as a free-draining soil with some moisture retention. When we look for a soil we need to balance several issues; why choose a soil that has excessive drainage if this means watering every hour. On the other hand, a fine-grained soil will retain water and could mean our bonsai stays too wet. The answer also depends on the trees you grow: a pine likes dry, a maple more wet, and then wind will draw moisture out of the tree faster. Consider all of these things and look for a soil mix that balances your ability to support your bonsai with the characteristics of the soil you use.

Some of the common components in soil mixes are:-

- Akadama
- Kanuma
- Kyodama
- John Innes
- Moler clay
- Loam
- Aggregates
- Clay
- Silt
- Organic matter
- Humus
- Coir (Peat substitute)
- Peat
- Leaf mould
- Pine bark
- Pine needle litter
- Horticultural grit
- Horticultural Sand

All of the above is simple, and doesn't look at the impact of colour and pot selection on root warming; this is a whole level of further consideration that is vital to consider with our short growing season. The quicker a pot warms, the faster our trees will grow...

Not really soil ingredients but part of the flora and fauna that support a healthy soil and provide nutrients for our trees, we can consider adding humate or mycorrhizal spores. These support our tree, making it easier to absorb the nutrients required. Humate soil additives such as *Organic Ancient Humate* and/or mycorrhiza *Plantworks Rootgrow™ Plus* provide stimulus and a richer micro environment to support bonsai growth. I understand that the Humate contains humic acid—a good chelator—and makes it easier for the plant to absorb nutrients. The mycorrhiza act symbiotically at the transfer layer between root and environment, and also make absorption easier.

A gentle boost can also be provided at re-potting with *Maxicrop Seaweed Extract*.

In general, and to conclude, it is worth noting that each of our trees will ideally have its own soil mix so that fast-growing trees are provided with more moisture and nutrients, deciduous trees tend to want more organic mixes, coniferous like free-draining open soils. The impact of your pot selection cannot be ignored. Shallow pots dry quickly and warm quickly, deep pots dry slowly and stay cool longer.

4. How

HOW DO I RE-POT?

-2 days to Potting Day

- Allow your tree to dry a little more than usual, this makes root separation and soil removal a little easier.
- Select your pot and prepare it, i.e. mesh drainage holes and place anchor wires. The wire for the anchor lines needs to be approximately 1.0mm for small trees, 1.5mm or 2.0mm wire for larger trees if it is to be sufficiently robust.

Potting Day

- Make sure you have enough of your soil prepared and sieved.
- Lightly prune the tree.
- Cut tie-down wires and remove tree from pot. This may require a pot saw or pot hook if the old soil/roots have filled the pot and hardened.
- Assuming a “normal” re-pot – rake out the edges of the soil and the bottom of the trees root ball. Chop sticks, steel picks, root hooks and root rakes may all be necessary here or simple water pressure from the garden hose sometimes does the job.
- Remove all of the lateral roots that have grown, then balance this to a total of approximately 10% (weak tree) to 30% (strong tree) of the root mass by pruning the feeding roots. Every tree is different and it is better to be cautious rather than sorry until you know your trees well, and prune the roots a little lighter rather than to do so heavily and kill the tree.

Mist roots as you work to avoid drying and tips dying.

- If the tree is well established you should take two or three wedges of “old” soil out from areas of weak root growth, i.e. where very little roots are growing in the area. This allows gradual replacement of the “old” soil.

Mist roots as you work to avoid drying and tips dying.

(This is typical and while, for example, a Chinese Elm might be root washed at every re-pot, this would be a disaster with a Pine. With Satsuki Azaleas in particular, but with several deciduous trees (not Oaks), Junipers and Yew, root washing can be desirable at least occasionally).

- Cover the root ball with a damp cloth while you make final preparations with soil and pot.



- Prepare the pot by placing a hill of soil behind the side-to-side centre line, and to the left or right of the front/back centre line.
- Place your tree on this hill and rotate back and forth into position, the hill filling any voids in the underside of the tree's root ball. The tree should finally rest with the root ball's crown a little above the pot's top edge.
- Pull the anchor wires loosely into position.
- Fill the pot loosely with soil.
- Twist the anchor wires to hold the tree firmly in place. It is sufficiently tight when you can lift the tree at this stage without disturbing the soil.
- Work the loose soil into the voids and gaps with a chop stick, inserting it and wiggling it radially along the lines you would like the roots to grow. Wagging the chopstick across the line of the preferred root growth tends to tangle the roots, and stabbing/pushing the soil in with the chop stick tends to cause bruising and other root damage.
- Check the tightness of the anchor wires and retighten if necessary.
- Use a rubber mallet or your fist to vibrate the soil into the pot, tapping and rotating the pot to ensure even settling and compaction.
- Tamp the top surface.
- Dress the top surface with a 5.0mm layer of fine soil.
- Tamp the top surface again.
- Dress the soil with chopped sphagnum moss, pressing it very firmly into place.
- Mist the tree and its surface, and then water the tree thoroughly until all of the fines in your soil are washed through and water is running through pot clear.

And that is it for the re-pot! Next comes Aftercare...

5. Aftercare

I HAVE RE-POTTED, NOW WHAT DO I DO TO SUPPORT MY BONSAI'S RECOVERY?

At the end of the re-potting sequence, we watered our tree very thoroughly. The important thing now is not to water the tree again until it is dry. This does not mean 'bone dry'—the result would be a dead tree—but 'plant dry'. At this point, water the tree again thoroughly.

Misting is mostly an exercise in personal comfort; there is little evidence to prove any benefit and some evidence that harm is done, i.e. increased mould risk.

Placing the tree in shade is reasonable, although—unless you are re-potting in the middle of the summer—not entirely necessary as our spring temperatures and daylight rarely get to a level where they would cause harm. The exception being possibly late re-pots where high summer temperatures and sunlight could cause some problems.

Protect your tree from wind and extremes, try and keep rain off the tree initially.

Watch out for pest attacks. Your tree needs its sap more than the pests, particularly at this time with the tree trying to remake roots.

Restart fertilising/feeding your tree when you see evidence of emerging top growth. At this time, the tree will be ready to absorb and use the fertiliser. Doing so earlier will be of little or no benefit, and could harm your tree's recovery from the re-pot.

6. Conclusions

There is a lot more to re-potting than most of us think initially, and a lot to consider.

There are libraries full of bonsai and horticultural practice that can be absorbed in understanding the Why, What and When of re-potting.

The How fills yet another library, with a great part of it offering contradicting views and opinions—some based upon quantitative research, some on anecdotal evidence, and even more based on personal practice.

All of this has its place; the key takeaway is in understanding the implications and details of the specific points and practices of individual studies, then putting it into practice—developing both your practical and theoretical knowledge of the art, craft and science that is bonsai. This is what helps you grow, along with your trees.