PART 1:

# A good bonsai matrix/soil

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It's interesting to me how complicated people make the subject of creating a beneficial soil for bonsai, or for any plant in a pot for that matter. It's not hard to do, but it must start with the right concepts.

Actually, since a good potting soil is such a specialized product, it would rightfully be called a "potting matrix" for there is often no natural soil involved in it.

Let's start at the beginning. We'll use the term "soil" since it is the term most people are acquainted with, no matter what the particles are composed of.

**To make a very healthy bonsai soil**, one must keep several characteristics in mind. First, it must hold enough water so as to stay moist from the last watering to the next. At the same time, it must be able to hold enough air so as to keep it from being waterlogged. Also, the air must be sufficiently distributed so the air pore spaces don't make such large voids that they can become completely dried out and without access to water. Thus the air pores must be carefully sized so the edges of the particles around the air pores can maintain a layer of water on them; that is, the water layer can be continuous without filling all the room between the matrix particles and thus – even for a while – fill the matrix so completely with water that there is no room for air. Spoken differently, it is critical to have, not just enough air in the mix, but to have all the air pores the right size. To do this we must have all the particles of the right size, and, to whatever degree it matters, the right shape as well. The right level of acidity and/or alkalinity (the pH balance) is also necessary. The correct level is usually somewhere around a neutral or pH balance, which is called a pH of 7. This is important, not only for the bonsai, but for all the other plants growing in the same pot: the moss (if any) and the beneficial organisms growing in the soil which are bacteria and the correct form of fungi which live in conjunction with the plant's roots. So if we have the right amount of water, the right amount of air, the correct air pore sizes and the correct pH, we are well on our way to having a very healthy environment for our bonsai. One question with a non-obvious answer remains: how to get the air pore spaces of the correct size. The answer lies in the fact that we must have the correct soil particle sizes.

**To maximize the air in the mix** we must have all the particles of the same size. If there are many different soil particle sizes, the small ones will fill in the potential air pores among the other larger particles. Not to belabor the point, but just in case any confusion remains, consider the following mind experiment: Fill up a container with large particles (all the same size), pebbles, for example, and then fill in the remaining room with some fine sand. Shake it a little bit. The result will be no growth in the volume of the soil; it will all go into the voids between the larger soil particles, thus only reducing the air in the mix (which we definitely don't want). Therefore it becomes obvious that all the soil's particles must be the same

size (approximately) so as to maximize the air and optimize the air pore space sizes (optimized if we start out with the correct soil particle size to begin with). That particle size which works best has been found by soil scientists and many bonsai experts here, in Japan, and in China too, to be between ¼" and ⅛". No larger particles (which simply take up space and don't allow roots to grow in that area), and no finer particles (which take up air space and, while allowing roots to grow in those areas, reduce the total air and oxygen available to the plant and thus increasing the possibility of anaerobic microorganisms and disease. Some people add peat moss or other fine organic matter, but it increases the likelihood of disease. There are other organic matter components that we can use that will also hold water, and are much healthier for the plant.

A number of companies, headed by the better bonsai experts, sieve and create such balanced soil mixes, all of which are created of more or less similarly sieved particle sizes, and we would recommend such a mix for your bonsai.

PART 2: A Good Bonsai Soil Matrix

As we said in part 1 of A Good Bonsai Soil Matrix, perhaps the most important aspect of a good soil mix is the size and quantity of the air pore spaces. They must be of the right size and the soil must have enough of them to maintain plenty of air in the mix, as much of the time as possible. Were we to put very fine particles in the mix with the larger, primary sized particles, they would filter into the air pores and, to some degree, clog them up. The amount of air in the mix would be reduced.

Let it be said again, for it is so important: to maximize the useable air in the mix and optimize the air pore space size, we must have all the soil particles of roughly the same size.*

If some of the particles were much larger, they would simply take up space and reduce the amount of useable matrix that the roots could grow into and, If some of the particles were much smaller, the roots would be able to use that area and grow into them, but the air pores would be so small that they would likely stay filled with water and thus promote pathogenic anaerobic microorganisms.

**Air is critical to the roots.**

Consider a pile of garbage. When it has been just piled it may still have some air in it, and won't smell too rank. However, put it in a closed black plastic garbage bag in the sun for a few hours, and, as we all know, it will begin to smell horrible. In fact, it smells horrible because it is horrible. Our noses give us warning that something is amiss – and the gases given off by the rotting vegetative mass in the bag are our warning.

I remember doing a demonstration a few years ago and was brought a plant – quite well styled, actually, but was clearly sick. The symptoms were dying leaves

at the end of the branches, especially dying back around the edges and the look of a soil whose particle sizes were way too small, or non-existent to hold any air. Immediately, without looking at the plant further I said "it needs repotting and the soil changed." With such a quick cursory glance that I took some of the audience members were skeptical. I, across the room, and too far from the object to perceive its odor, nonetheless suggested they smell the root mass. That settled the discussion, for it was fairly rank and clearly the reason for the plant's distress. In the same fashion, we can smell a beneficial environment for the roots: the rich loamy soil which by its smell indicates it is filled with healthy root-promoting microorganisms, most usually the mycorrhizae (meaning "fungus root") which act like an extension of the root system and help to keep it healthy. In fact, some plants can't grow (or at least not grow well) without these beneficial microorganisms. One way to show this is to take a plant that seems to require them and dose the root ball with one of several fungicides. Although other plants might thrive, the fungicide, while not damaging the roots directly, will kill the plants because the extensions of the roots – the good guy fungi – will be destroyed.

The best and easiest way to make certain beneficial fungi live in the soil is to deliberately inoculate it with some soil from a healthy plant of the same or similar species. The Japanese have done this for hundreds of years with plants of varieties that are known to need these fungi. Very few pines, for example, almost always are treated in this way when being planted or transplanted, To extend your knowledge of what species of fungi grow well with what species of pine, experiment with different inoculants to see which do best with which trees. You may be surprised by the difference in growth.
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*An interesting experiment can be made by placing larger particles of soil at the bottom of the pot. It's a tradition of long-standing but isn't healthy for the plant, and proves the need for the soil particles to be of similar size. The reason is that, at the bottom of every soil layer, there is a saturated layer of soil, called a "perched water table". It will remain in that soil. Thus there will be even more saturated soil (in two levels) that can't be made use of by the plant. Believe it or not, we could even create a third perched water table if we were to add a third layer of a different sized soil particle (not that we would want to, of course).

Keep Your Creative Mind Alive,

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