

Watering Woes...Salts

By Charlie Mosse, September 2021

Watering on its face seems very simple. It is in a way, yet in the bonsai world it is much more complicated. Adding to the complexities is the cold fact that our water has been getting more mineralized as the drought continues and we still have to wrestle with the chloramines added to keep the water safe/potable. This keeps the pH up which does affect nutrient availability. The optimum range for most plants is pH 6-7.

We have all seen the water spots on things like windows, counter tops, faucets, bonsai pots, concrete, masonry walls, etc. We get the majority of our water from the Colorado River and it is full of these salts. The problem has gotten worse over the past decade and is going to worsen as the drought continues. Salts in the water are not new, but the concentration seems to be going up...I know it is with the water in my area.

Salts are in the water and in all chemical fertilizers. Basically, fertilizers are specifically formulated salts. Organic type fertilizers have a lot less salt and are not considered to be a problem unless the organic source has salts which are not removed during manufacturing.

Salts are generally soluble in water which is what helps them to be available to the plant and to soil organisms. Therefore, when we water and fertilize our plants, we are adding salts to the soil. The salts will accumulate in the soil up to a point. If we are watering properly, we add some salt, we wash out some salt hopefully keeping salt accumulation to a reasonable level.

Fresh soil starts out with minimal salts. In time salts accumulate in the soil, on top of the soil, on the edge of the pot, on the feet of the pots, on exposed roots and on the nebari. Removing the salts is one of the many maintenance chores we have in bonsai.

Leaching salts from the soil is a very important part of the watering process and can have a minimal to profound effect on plants. The degree to which salt will build up in the soil is based on soil components, particle size, watering technique, container depth, container material, types of fertilizer, the weather, and of course your water. The degree to which salt will affect a plant depends on the amount of salt build up, the types of salts, the plant variety and yes, the weather. During hot weather we water more. The more we water, the more we may need to fertilize, if not for growth then just for good plant health to help the plant through heat-stress times.

Leaching: Texas A&M University:

Leaching is the process of adding sufficient water to the soil to dissolve salts and carry them from the root zone.

When the salt concentration is greater in the soil than that of the plant, the water moves from the plant back into the soil. This will cause wilting, root hair loss, fine root loss, and in higher concentrations salts can be toxic to plants. High salt concentrations can also cause some nutrients not to be available to the plant which is also an issue with too high or too low of a soil pH.

All soil components absorb salt to some degree. Components that absorb and keep water in their structure also absorb salts. The salts in the water, in the soil components and in the fertilizers all add to the total amount of salts in the soil. Most salts are OK in the correct amounts. But, an excessive amount of any salt and/or an excessive total amount of salts will

cause some type of harm to the plant like slightly off color foliage to badly burned foliage. Badly burned foliage can also be an indicator of damaged roots.

The basic soil components we use are pumice, scoria, bark (organics) and akadama. They all can accumulate salts on the surface and exposed pores. Pumice can absorb some water and therefore can absorb some salt. They are absorbed in the very tiny air spaces created during its "birth". Scoria can also absorb some water and salt but mostly in the tiny pockets created by the gases during its "birth". It gives up the water and salts fairly easily. Bark has a good Cation Exchange Capacity (CEC) and absorbs water and salt on the surface and into the tissue. It does give up both but will keep some of the salts. Akadama is a clay and has a high CEC so it absorbs water and salts/nutrients but does release both. However, akadama does keep a fair amount of salt/nutrients. Note that roots will readily penetrate akadama splitting it apart. The roots will take up some of the salts/nutrients as it penetrates the akadama. In splitting the akadama, this exposes the akadama to the water where some of the salts/nutrients can be put into solution when watering and, are either flushed or are utilized by the plant. Some of the salts will remain in the akadama not a problem is salts are kept under control.

So how do we mitigate the salts that we do have to contend with and how do we prevent or minimize the accumulation of salts in the soil?

1: Use rainwater, whole house filter systems or a de-ionizing (DI) unit just for your plants. This is the best way if you can swing it. If you use any system that removes most or all of the minerals and salts, you will need to add some back into your fertilizing program. The better fertilizers have those blended into them. Or, once a month or so, water with your tap water will help provide a few minerals.

2: Minimizing salt accumulation can be done by alternating good sources like rainwater with tap water. It works nicely. Some plants do not really require this method like Junipers, Yaupon Holly and Ficus. Whereas, maples, azaleas, crape (crepe) myrtle and black pines prefer lower salt levels. In general, most plants benefit from proper levels of salt in the soil, it is just that some plants are more tolerant of salt levels that can be too high for other plant varieties. A good example would be Japanese Maples are sensitive and burn readily early in the year, Trident Maples are more tolerant but do suffer a bit but later in the year, and junipers tolerate salt levels that either maple will not.

Most people do not have enough rainwater to use for an entire year for all of their plants. Use the rainwater or DI water on only the sensitive plants since it is not necessary for the tolerant ones. Another way to stretch the rainwater or DI water is to save it for the hotter and/or drier times of the year, say July through October. Basically, stretch the good water out where you can.

Another way to minimize total salts in the soil is to fertilize more often with a lesser amount per application. Professional growers have used this method for decades since it mimics natural soil more closely. Nutrients usually do not vary rapidly in the ground like they can in a container, hence the development of slow release fertilizers and fertilizer injector systems. Keeping nutrient levels more even in the soil makes for a stronger plant.

3: What is the condition of the soil in each container? Newer soil in recently potted plants will accept water very readily. With time the soil becomes denser as the soil components breakdown and fertilizer residue, salts in the water, and surface-applied dry organics accumulate in the top parts of the soil like a glaze. Water begins to not penetrate as readily and can also start to not evenly wet the soil in the container. After 2-3 years or so the soil surface is

getting pretty hard to wet easily. Water is running off more readily, getting the entire root ball to evenly accept water is more difficult and less air (oxygen) is getting to the roots. It is now taking more water to properly water the plant. Not a good goal in the middle of a drought.

Solutions are simple. First one is to repot the plant. Problem solved.

Second is to improve the soil surface percolation which is being done more and more. It can save on soil and the time needed for a full re-pot and will definitely perk up the plant. [This can be seen in detail on Ryan Neil's website if you are member. Excellent video. Many members have used this beneficial method for hard surface soil problems.] Basically, you remove the moss if any and save it. Using chop sticks and a rake, remove the hard soil surface down to where you can see good soil. Be gentle where you can to minimize damage to the roots. Add new soil mix and press into the container. At this point you can add a soil cover consisting of screened sphagnum moss, screened to the same size as the soil mix particles you just added. This will help keep the soil particles in place and help a little bit with the pH. Now the water and air will more evenly penetrate the root ball and help assure better root health. This has proven to perk up a plant and save some water.

4: What methods/techniques do you use to water your plants? There are many ways to deliver an effective application of water. Some type of water nozzle with a soft spray like a hose-end Masakuni type nozzle, hose-end Soft Rain type nozzle, typical hose end nozzle with multiple spray settings, watering can with a gentle delivery, tank pressure sprayer, drip irrigation, the soaking method in a tub or bucket. These are all valid and effective ways to water but their effectiveness and reasons for use vary.

Effectiveness of watering and the ability to minimize salt build up varies with:

- the techniques used to water,
- soil mix,
- the condition of the soil surface as discussed above,
- the age of the root ball itself,
- the size of the plant vs the size of the container,
- locale in which the plant is grown aka general micro-climate,
- current weather conditions aka is it going to be hot, cold, windy etc.,
- the variety of the plant(s) being watered.

Nozzle type method: If the soil mix is new or relatively new it will accept water readily, then the nozzle type (Masakuni type, hose end or soft rain) application is efficient and will leach salts effectively. Three passes with the nozzle should be done at a minimum. The first pass is to wet the surface and just under the surface to promote breaking the surface tension that naturally occurs on a dry surface when first applying water. Some water may penetrate the root ball and come out the bottom but by no means is the root ball evenly wetted. The next two applications will wet the entire root ball and assure proper leaching of salts. Since new salts are added at each watering, decent flow out the bottom of the container must be done to minimize salt accumulation. As the soil surface and/or root ball become more difficult to wet, then it takes more applications to properly wet and leach salts from the root ball. This is very important during hotter and drier times of the year and especially just before and during heat spikes.

Tip: When using the typical multi-setting hose end nozzle, most people use the shower setting on low and turn the nozzle (flow) upside down to imitate rain. If the soil has become hard, the shower setting is too much and flows off the soil surface. If the soil mix is very new, the shower

setting can wash away soil particles. Solution, use the fan spray setting low enough pressure so it will soak in or not erode. Works great. Then you can turn the pressure on full on the fan spray setting and give the plant a forceful cleansing and bug removal shower.

Tank Sprayer: Great way to conserve water but it does take longer to water and assure good leaching. It is a very effective way to water shohin sized bonsai and hard root balls. You can add some liquid fertilizer like MiracleGro, SuperThrive supplement or some of the fancy hydroponic formulations and supplement the usual fertilizing.

Drip Irrigation: We use this very successfully at the Safari Park Pavilion, at the Bonsai Garden at Lake Merritt in Oakland, and also at the Clark Bonsai Collection in the Shinzen Friendship Garden in Fresno. Many members also have set ups. Talk with any of the Pavilion managers for information and insight. Drip is a bit of a misnomer here in that the water does not drip in but is applied via an emitter that sprays out a good flow of water. Good leaching also occurs as one can see almost no salt damage to the plants in the pavilion except of course the sensitive ones, but even that is minimal.

Soaking in a tub/tray/bucket: This is a great way to water very hard root balls, very dry root balls and shohin. Newly planted trees can be watered this way too but it is better to flush the new soil first with the nozzle watering method to remove all of the soil fines. After that, if you water new soil by soaking, lower the pot into the water slowly to minimize the loss of soil particles floating away.

Tip: Cover the new soil with drainage screen and wire it onto the surface, then no soil will escape no matter how you water. Another benefit of the screen is that it will slow the drying of the soil, especially the soil surface, and it does protect the pot a little from the sun.

Soaking trees such that the root ball is evenly watered takes anywhere from a minute to 15 minutes depending on how compacted the soil has gotten. For most soils, waiting until the air bubbles quit coming out is a minimal amount of time. Wait for a minute or two after the bubbles have stopped coming out to remove the plant from the water. If the root ball is really dry and the tree looks a little stressed, you may want to leave it in the water longer. Remove the tree(s) and set at an angle to assure proper drainage of excess water, especially shallow containers.

Does soaking remove salts? Yes, it does. Salts on the surface will go into solution while soaking and then when the pot is removed, the drainage will remove some also. However, watering from the top is more effective at removing salts if you have good soil percolation.

Tip: If the trees are not stressed, soaking them in the tub with your favorite fertilizer solution works great. This is especially good and easy to do for shohin or for badly compacted root balls. In speaking with several people who water this way at times, they use Miracle Gro with fish emulsion/kelp or Miracle Gro with kelp or just fish emulsion. I have used this often and will even add SuperThrive for plants with injured roots or plants that are going through a full or partial re-pot when the final root trimming has been completed. Soak them for about 10 minutes.

Note on SuperThrive: Current analysis...Total Nitrogen 0.5% ...Water Soluble Nitrogen 0.4% Water Insoluble Nitrogen 0.1% Vitamin B-1 0.09% 1-Naphthyl Acetic Acid 0.048%. Soaking roots before planting or soaking plants/pot when watering, SuperThrive does have a tiny bit of nutrient value. It now contains kelp with its minerals and trace elements. The 1-Naphthyl Acetic Acid root hormone will help a little bit with stimulating roots. Vitamin B-1 was proven decades

ago to be of no benefit but it does help sell the product. People like the word vitamin in it. It is misleading but SuperThrive is an otherwise beneficial product.

Excellent information on watering is found on Jonas DuPuich's site, [Bonsai Tonight](#), and also on Ryan Neil's site, [Bonsai Mirai](#).

Watering takes time to learn for all of its nuances with different soils, water quality, ages of soil, plant varieties, pot types and materials, local weather, and your own micro-climate in your yard. Even conditions in your yard change from daily, month-to-month, from morning to afternoon and year-ro-year. Providing good watering to your plants is a challenge. Practice, observe, experiment and seeing what others do will serve you well.