

Fertilizers....A complex subject but easy to distill in time.

By Charlie Mosse, August/September 2022

The topic of fertilizers is confusing on a good day and very frustrating on other days. It is a very broad subject to start with but, over time you will distill the information and it all will become clearer. You will select several fertilizers to use that fit your needs. Today we will start chipping away at this complex subject.

If you do not have the experience with fertilizers then:

-Ask club members at the monthly meetings.

-You can also pose questions on:

- **SDBC FaceBook page** or,
- **Email** the question(s) to the SDBC email on the website at...<https://www.sandiegobonsaiclub.com/contact.html>.

Members will definitely benefit from these questions.

Good discussions of fertilizers can be found at:

- Ryan Neil of Bonsai Mirai in his Forum Q&A, Live Q & A and Live Streams.
- Jonas Dupuich of BonsaiTonight in his Blog where topics are cataloged.
- Eric Schrader of Bonsaify in his blog and on his site.
- Michael Hagedorn of Crataegus Bonsai. He wrote an excellent book that covers many topics about growing bonsai called *Bonsai Heresy*. His book dispels many myths about growing plants that we have been taught over the years and nicely covers fertilizing bonsai.
- Bjorn Bjorholm of Eisei En Bonsai.

Soil chemistry is very complex. To start, having a soil test conducted is a good to do so that you know what nutrients are in the soil. But note that most bonsai soil mixes out of the bag or freshly mixed have little nutrient value to them to start with. So, a test at this point could be pointless. It is safe to assume that there is essentially no nutrient. Once you start fertilizing and you have some issues, then a test can be very useful.

However, not all soil tests are equal. Some are inexpensive but do not tell the whole story and some are more costly but give you more important detail. A result from an inexpensive test may tell you how much NPK and other nutrients are in your soil but may not tell you what the different types of N,P,K and whether or not they are even available to be taken up by the roots. But even an inexpensive test is a good place to start.

I received an email from a member who was reading a nursery ad for various fertilizers. It made them wonder what the significant differences are among the many fertilizers sold today. Aside from trace elements which most manufacturers incorporate

into their formulations, how different is a 5-5-5 from one company compared with a 5-5-5 from another company? How different are the fertilizers from the same company that state they are for different purposes like Rose fertilizer vs Vegetable fertilizer vs Tree fertilizer vs Acid type fertilizers where the NPK (Nitrogen, Phosphorus, Potassium) numbers are only a few percentage points different? Many times when there are small percentage differences or no difference in fertilizer content it does not much matter which one you use. The different labels are mostly for marketing to us to make the choice easier and also hoping we will buy more than one bag. Not misleading, just confusing sometimes.

To start, a good example within one brand is the Espoma Tones group of organic fertilizers by Espoma Organic Fertilizers. Good products of which several are used by quite a few members, primarily Plant-tone, Holly-tone and Soil Acidifier (gypsum+soil sulfur for lowering soil pH). The NPK, calcium and sulfur are essentially the same. The only significant difference among the fertilizers is the amount of sulfur in the Holly-tone which is much higher than in the Plant-tone to help lower the pH and the calcium in the Tomato-tone to help with tomato blossom end rot. Can the Holly-tone or Plant-tone be used on the same plants? For the most part, yes, and there will be little if any difference in the plant's health. With our water quality problems, Holly-tone is a good choice for use as a general fertilizer. Note also that all of the fertilizers have the same sources for the ingredients so that variable is eliminated.

	Nitrogen (N)	Phosphorus (P)	Potassium (K)	Calcium (Ca)	Sulfur (S)
Plant-tone	5 (.4,1.6,3)	3	3	5	1
Holly-tone	4	3	4	5	5
Tomato-tone	3	4	6	8	2.5
Flower-tone	3	4	5	5	1
Garden-tone	3	4	4	5	2

Nitrogen is mostly water insoluble with small % of ammoniacal and other water soluble N. Numbers in parentheses in order are % of total nitrogen : ammoniacal fast release, other water soluble N that is quick to moderate release, and water insoluble like urea and organics are slow release N.
Ingredient info was taken directly from the labels.

Knowing the types of nitrogen in the fertilizer will tell you how quickly the nitrogen will be available. Looking at the Plant-tone, only a small amount of nitrogen is quickly available for a brief, slight boost. Most of the nitrogen is moderate to slow release. This analysis can be done with any properly labeled fertilizer.

Note that organic fertilizers need soil contact for the soil organisms to convert the organics to usable forms. Direct application to soil surface is OK but adds to the surface crust over time. Scratching it in helps. Using tea bags or fertilizer baskets work well but must have good soil contact for the soil organisms to act on the fertilizer.

Fortunately for us, so much more is known about how plants and how fertilizer's function in the soil. This has given rise to more scientific reasons for how fertilizers work rather than relying on urban legends and outdated information. Many changes have occurred in the last several decades and substantial changes have occurred in the past decade...knowledge is constantly evolving.

There are dozens and dozens of fertilizers on the market; many brands, many formulations within a brand and the formulations come in various states (see below). This adds to the fray. So, one needs to know the lingo and what the numbers mean. Then you can read a label and have a good idea of what you are looking at.

Many factors affect how fertilizer reacts in the soil:

- Types of soil mix components.
- Ratio of soil mix components.
- Age of the soil mix in a container. Is the soil fresh with fast movement of water through the soil or, is the water moving through the soil slowly and unevenly due to soil compaction with age and salt accumulation. Uneven movement of water=uneven distribution of fertilizer.
- Watering technique used for each plant. Technique will vary by plant due to soil age, soil components, species and to a degree the stage of development.
- Temperature of soil. Organic fertilizers release more quickly with the increase in temperatures as we see in the spring, summer and early fall. Controlled release fertilizers like Apex and Osmocote releases more fertilizer with increasing temperatures, up to a point so that damage does not occur.
- Daily temperature fluctuations in the soil. If you water when it is cool, less fertilizer is released by controlled release fertilizers. Daily fluctuations do not affect organics in the same way.
- Microbe activity increases with the temperature of the soil mix which increases nutrient release. Organics breakdown and release more nutrient in summer than in winter. So, using controlled release is a bit more consistent than organics most of the year. Miracle-Gro is good to use in the cooler months if your plants need a boost since it is a chemical fertilizer
- Water source pH will affect the release and availability of NPK and particularly micronutrients (iron, zinc, magnesium, manganese and all others).
- Water source alkalinity (mineral content and mineral type), our issue is with calcium carbonate which you see on the ground, pots, benches, water wands etc.
- Degree of accumulation of salts on/in the soil surface. Build up will happen and make the soil surface "crusty" and more water repellent thereby reducing the penetration of water and nutrient into the soil.
- Soil cover, if used. Soil covers contain sphagnum moss and some soil mix to help with water retention and soil erosion. The cover will also absorb minerals

from the water/fertilizer and eventually become more water repellent again reducing the penetration of water/nutrients into the soil.

- Accumulation over time of organics on the soil surface and in the upper layer of the soil mix. The organic fertilizer residue and breakdown of bark and akadama will also absorb minerals and act as above.
- Lastly, the fertilizer formulation itself. Organics generally are slower to release than chemical fertilizers like MiracleGro, particularly in the cooler months.

Good watering habits are particularly important to get even distribution of water through the soil. If needed, improving the soil surface percolation by replacing the soil mix in the top 1/4" to 3/4" with fresh soil mix. This ensures more even movement of water the fertilizer. You will get more effectiveness out of your fertilizer doing the above.

Regardless of the fertilizer brand, one needs to spend their time knowing what the formulations mean and which state* will work best for the needs of your plants and how you like to fertilize. Homework, speaking with others, and personal use (trial and error) are needed to determine what fertilizers are best for your trees. Like watering, fertilizing does have a learning curve. You will change what you use with experience.

State* means:

- Crystalline form for dissolving in water such as Miracle Gro. Always quick release.
- Pelletized types like Milorganite which is slow release and many common brands which are quick and slow release types of nutrients.
- Tablet types like Gro-Power tablets. Generally quick release but are semi-controlled release since they are in a hardened tablet form.
- Formed types like Biogold, other Japanese bonsai fertilizers or homemade organic fertilizers cakes. Always slow release.
- Membrane types like controlled release Osmocote and Apex. Always controlled release but with quick release types of nutrients.
- Dry organics like Dr. Earth and Espoma Holly-tone and Plant-tone that are ground and mixed and dusty with other debris from the various sources like the different meals.
- Liquid types that are pre-mixed like fish emulsion and fish hydrolysate, and homemade or manufactured fertilizer teas.
- Greenhouse liquids that are highly filtered and pricey for use in more commercial operations with injector systems and exacting requirements. The products are available to us.

Quite a few fertilizers are being created using some form of technology that controls the release of the nutrients. Less fertilizer is lost due to leaching out of the container and out of the root zone in the ground. This technological advance is in response to the

pollution that fertilizers can bring to the environment when applied too often and simply too much. These newer formulations and the widespread use of organic fertilizers are here to stay. They make sense.

There is a mis-understood term which does make a difference in understanding fertilizer activity. **Slow release:** Slow release means that a fertilizer component such as nitrogen needs to be worked on by soil organisms before it is available to the roots for uptake. Urea and organic forms of nitrogen are more slowly released to the plant than quick release chemical types like nitrate (NO₃) and ammonia (NH₄). These are readily available to the plant and highly water soluble...mobile. **Controlled release: Fertilizers** such as Osmocote and Apex prills (BBs) utilize a membrane that controls the release of the nutrients. The form of nitrogen that is within the membrane for Osmocote is nitrate nitrogen and ammoniac nitrogen which are quick release chemical forms of nitrogen readily available to the plant roots but the release is **controlled**, that is they are metered out by the membrane system, watering frequency, amount water per application and very importantly the temperature of the soil. Apex works in almost the same way as Osmocote and also has nitrate and ammoniac nitrogen, and also has Urea nitrogen which is a slow release form of nitrogen. Urea takes a day or two to be released upon being watered in, whereas nitrate and ammoniac nitrogen are available immediately upon being watered in. Apex is a better combination of nitrogen but at least both are controlled release helping to reduce fertilizer loss/waste.

Sometimes slow release fertilizers controlled release fertilizers are misunderstood as both being organic fertilizers. Slow release is organic based. Controlled release can be organic or chemical but is usually chemical because the release of a chemical is more reliably controlled.

There are others but the above are well known to the bonsai community and regularly used, some very extensively. More fertilizers and combinations of fertilizers will be covered later that are used by club members and bonsai professionals in the west and southwest.

You will make some mistakes along the way so be patient and ask a lot of questions. Stuff happens...even to the most experienced bonsai enthusiasts. It is highly recommended to experiment with less expensive nursery plants of specific species to learn how to grow them. Then you will be ready when a really nice tree comes along to purchase.