# Bonsai Fertilisers

Executive summary

* Bonsai do best if regularly fertilised during Spring and Autumn. Some may struggle to survive without fertiliser.
* There are lots of fertilisers, none of which is perfect. Seaweed extract, used lightly, is fine for beginners.
* Over-fertilisation can be as big an issue as under-fertilisation. Some experimentation is necessary!

Why we care about fertilisers

* Bonsai are typically grown in small pots, without access to a larger soil volume and broader ecosystem to provide scarce nutrients. The soil thus needs “amendment” to provide the right nutrition.
* In the training stage, bonsai are grown in organic soils or in the ground, for rapid growth. However, if the soil happens to be poor in one or more key nutrients, this can limit the tree’s growth or reduce its vigour.
* In the refinement stage, bonsai are typically grown in nutrient-poor inorganic soils (clays, pumice, sand, etc), since this helps restrict their growth. However, it is possible to restrict growth *too* much!
* A major reason for practicing bonsai is to learn “silvics”: tree science. Controlling a bonsai’s nutrients carefully and seeing how the tree reacts can give us insight into how these soil components affect a wild tree’s growth.

## Fertiliser components

### “Primary macro-nutrients”

* Elements: **Nitrogen** (N), **Phosphorus** (P), **Potassium** (K)
  + Nitrogen is important for chlorophyll manufacture in leaves. Deficiency leads to leaf yellowing. Excess (“toxicity”) leads to leaf death around edges and in gaps between veins.
  + Phosphorus supports growth of roots, trunks, seeds and fruit, as well as general health. Deficiency leads to darkened – often purpleish – leaves due to poor transport of photosynthesised sugars. Excess leads to leaf discoloration around edges and in gaps between veins.
  + Potassium supports general plant health – especially water uptake – and encourages flowering / fruiting. Deficiency leads to yellow or purple tints at leaf edge. Excess causes symptoms of other nutrient deficiencies, particularly nitrogen and magnesium.
* Quoted on many fertilisers as an “N:P:K” ratio – e.g. 5-5-5 (balanced) or 10-1-3 (nitrogen-heavy).

### “Secondary macro-nutrients” and micro-nutrients

* Secondary macro-nutrient elements: Calcium (Ca), Magnesium (Mg), Sulfur (S)
* Micro-nutrient elements: Copper (Cu), Iron (Fe), Manganese (Mn), Molybdenum (Mo), Zinc (Zn), Boron (B), Silicon (Si), Cobalt (Co), Vanadium (V)
* These have a range of effects on tree health. Typically, if your leaves go a funny colour and you can’t spot any pests, it’s worth considering micro-nutrient deficiency or toxicity as a source.
* If you’re using an organic fertiliser, it’s relatively rare for bonsai to develop a serious micro-nutrient deficiency. Toxicity is slightly more common, e.g. if field-growing a tree in contaminated soil.

What makes a good bonsai fertiliser

* Balanced – e.g. NPK ratio of 5:5:5 or 7:7:7.
  + Most fertilisers focus more on Nitrogen and Potassium, since these encourage green growth (e.g. for grass) and small fruit (e.g. for strawberries). Bonsai practitioners want these things… but they want strong root and trunk growth too!
  + Phosphorus tends to linger longer in the soil than the other two macro-nutrients… but bonsai trees’ soil gets replaced typically every 1-3 years!
* Slow-release
  + We typically want fertilisers that will release nutrients over an extended period rather than all at once, so the tree can absorb them before they wash away.
  + This usually means solid rather than liquid fertiliser for most of the year. Liquid fertiliser may be used as a top-up in peak growth seasons.
  + Note: solid fertilisers can often be liquefied by sticking them in a mesh grocery bag or similar and leaving it in a full watering can. (The mesh is needed to stop chunks of fertiliser clogging the can’s rose.)
* Hygienic
  + Some fertilisers – most notably human faeces – pose a health hazard to users. The product of e.g. composter toilets should be used with care, by experienced gardeners only.
  + Some fertilisers – e.g. oilseed rape pellets – can be attractive to rats, especially in an urban environment. Not only is this is a disease risk but, if a rat is getting the nutrients, the tree isn’t!
  + Some fertilisers just smell absolutely awful. These may be useable for outdoor bonsai, but certainly not for indoor trees!
* Non-synthetic
  + Production of synthetic fertilisers can have a higher environmental footprint than purely natural fertilisers.
  + Natural fertilisers generally have enough micro-nutrients that no further amendment is needed.
  + Be warned: the label “organic” on fertilisers can be used to describe a mix of non-synthetic and synthetic fertilisers.
* Animal-friendly
  + Many fertilisers are made of animal byproducts: either bone meal, blood, or just manure.
  + Ethical vegetarians / vegans may not be comfortable using some or all of these products in their work.
  + More pragmatic practitioners may still wish to ensure that byproducts are from well-treated animals. Notably, Japan has a shaky record on animal welfare, so exported specialist fertilisers can be suspect.

## Common fertiliser types

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| Type | Description / pros & cons | Popular brands |
| Chicken manure pellets | Best brands are fermented, both for hygiene and to avoid leaf burn.  Naturally slow-release; some brands are also balanced.  Possible ethical issues re chicken welfare for imported brands!  Smells *horrible* if left in drip tray too long! | BioGold (Japanese) |
| Synthetic pellets | Offers more precise control over macro- and micro-nutrients.  Doesn’t always provide the full range of micro-nutrients, so further amendment may be needed.  Be aware: pellet contents are *highly* concentrated! | MiracleGro |
| Seaweed | Typically liquid.  Can be harmlessly micro-dosed – i.e. add a few millilitres to the watering can every time you water.  Tends to be low in macronutrients, particularly phosphorus. | Maxicrop |
| “Worm tea” | Actually worm manure – don’t drink this tea!  Tends to be low in macronutrients, particularly potassium. | Walworth Gardens! |
| Fish, blood & bone | Tends to be naturally balanced.  Can be sold as powders (fast release) or pellets (slow release).  Made of animal byproduct – possible major ethical issues!  Also some possible health issues, although powder inhalation is more of an issue than disease transmission. |  |

* In theory, a mixture of seaweed and worm tea should be both ethical and balanced. However, as of Jan 2024, I haven’t tested this yet.

## Environmental considerations

* Fertiliser run-off is a major environmental problem, leading to issues with water quality and toxic algae blooms. Whilst a handful of tiny trees won’t have a *huge* impact on this state of affairs, it’s best to keep good habits.
* Whatever fertiliser you choose, be aware of where the run-off is being carried when you water the tree. Onto a flower-bed or lawn is generally fine – the nutrients will be taken up by the local plants.
* If your trees are watered over a walkway or drain, you may want to use a drip tray, which you can occasionally rinse off onto a flower-bed. This gives your roses the benefit of whatever fertiliser your tree missed out on!

## When and how to fertilise

* When deciding a fertilisation schedule, the goal is to ensure that our trees always have the right nutrients – primary macro, secondary macro and micro – at the time when they need them.

### Growing seasons

* In temperate climates, trees typically grow strongly during Spring and Autumn (the latter is called “Lammas growth”), weakly during the height of Summer, and very little or not at all during mid- to late-Winter (the dormancy period for deciduous trees).
* When using solid fertiliser, fertilise heavily at the start of Spring and moderately after the hottest part of Summer.
* When using liquid fertiliser, use a high dose during early Spring, a moderate dose during late Spring and Autumn, and a low dose during Summer. Do not fertilise during Winter.

### Over-fertilisation

* It has been suggested that over-fertilising bonsai is difficult. I can confirm that this is not always true!
* Over-fertilising is dangerous; arguably more so than under-fertilising. At best, the fertiliser will just linger in the soil or form an unpleasant limescale-like crust around the edge of the pot. At worst – and especially with synthetic and liquid fertilisers – it will literally “salt the earth”, making it harder for plants to take up water or even sucking them dry.
* With trees in training, planted in potting soil, over-fertilising may clog up pores in the soil with scale, preventing airflow and suffocating roots. I *suspect* it may also accelerate the decomposition of pine bark and other loose composts, turning the soil into thick mush and again making it harder for roots to breathe; however, as of Jan 2024, I haven’t tested this yet.
* Over-fertilisation can also lead to trees throwing out long “water-shoots” or “whips”. These typically have a long inter-node distance and are thus basically useless for our bonsai: they’ll inevitably have to be removed later. In the meantime, they’re a waste of good growth, a possible source of unshapely bulges and cut scars, and a distraction for the tree from the branches we actually want to develop.
* In **Winter**, be careful not to over-fertilise as (a) dormant trees take up little or no nutrients, and (b) less frequent watering means fertiliser will linger longer in the soil.
* In **Summer**, over-fertilisation is somewhat less of an issue: the heavy watering tends to flush excess nutrients out of the soil. You may want to cut down on fertilisation in advance of any holidays or other periods where watering will be missed.
* In **Spring**, over-fertilising is difficult: the tree will take what we give it! However, be aware: more growth means more pruning is needed!
* In **Autumn**, growth is typically slightly less enthusiastic than in Spring since the tree is also prepping for Winter. Whilst it is unlikely your tree will die of over-fertilising in this season, be mindful that excess fertiliser may linger into Winter, when it *is* harmful.

### Tailoring the schedule

* Different species of tree may have different requirements. For example:
  + Evergreens get some benefit out of Winter fertilisation, whereas deciduous trees typically do not.
  + Conifers are more vulnerable to root-drying and hence to over-fertilising (see below)
  + Some trees emerge from dormancy earlier (e.g. cherry) or later (e.g. London lime) than others.
* Bonsai in training, planted in potting soil, can draw water back up into the soil in a way that refined bonsai, in inorganic soil, typically cannot. (See companion document on bonsai soils.) This also means that fertiliser in the drip tray can make its way back into the root ball, which helps prevent under-fertilisation but can increase the risk of over-fertilisation.
* The amount of fertiliser needed is proportional to the volume of soil in the pot: larger pots can safely absorb more fertiliser. It’s not a 1-1 relationship, though: smaller and shallower pots *also* lose more free nutrients to the drip tray, so may need slightly more fertiliser than one would expect from their size.
* Different individual trees may have their own “views” on fertilisation, for example based on their level of vigour. Over time you will hopefully build up a feel for this.
* Different brands of fertiliser may have their own quirks. Always read the instructions on the packet!