# Soil Testing for Organic Gardeners

By
Heide Hermary

SOUL
SOCIETY FOR ORGANIC URBAN LAND CARE

# Soil Testing for Organic Gardeners



## Published by:

Society for Organic Urban Land Care (SOUL)
www.organiclandcare.org
info@organiclandcare.org

Printed in Canada



## SOUL Mission:

"To support our communities in their transition to organic practices".

Our Goals:

- To foster and promote the practice of organic land care.
- To provide opportunities for education in all aspects of organic land care.
- To establish and promote guidelines, standards and specifications for all aspects of organic land care.
- To establish procedures for certification of organic land care practitioners
- To establish and develop a means for the exchange of information and ideas between the public and the organic land care industry.

Please join us - we need your support!
We welcome all landscape professionals and members of the public who support and practice environmentally sound land care

# Is soil testing necessary for organic home gardeners?

Organic food producers are required to test their soil every year to determine the type and amount of soil amendments needed to produce a bumper crop. The crop is then harvested and removed from the ecosystem. Farmers know that adding large amounts of concentrated elements such as lime, nitrogen and phosphorous, without knowing that they are actually required, can be very destructive to the soil. And expensive! Simply adding fertilizers "for good measure" is outright irresponsible.

But the scenario in our ornamental landscapes and home gardens is quite different. Here we are not harvesting and constantly "exploiting" the soil. Instead, all the organic matter generated by the landscape is recycled within the ecosystem. Where necessary, compost and leaf mulch are added to keep the plants well fed. The mulch also provides a moist, warm environment for all the little microbes that are hard at work, and it conserves water within the landscape. Organic gardening is really very simple.

Our goal is to have great, fertile soil so our garden will be beautiful and healthy. What we need to know is whether our soil contains all the "elements", and if not, which are missing.

The 3 most important elements for healthy soil are NOT nitrogen, phosphorous and potassium! They are:

- lots of mulch / organic matter
- great microbial diversity to break down the plant residue
- sufficient moisture to sustain not just the plants, but the microbes as well, without drowning them out.

This is true for ALL soils. The best way to improve clay as well as sandy soil is through the addition of organic matter. And it only makes sense:

- plant residue contains all the minerals plants require
- plant residue contains a lot of other organic compounds that plants require or enjoy for increased vitality and immunity to pests and diseases.
- microbes excrete compounds that bind soil particles and create an abundance of pores that can hold air and water – not just for themselves, but for the plants as well.

Organic fertilizers - which are derived entirely from the remains of living organisms - contain an abundance of minerals and other organic compounds. Organic fertilizer blends are formulated to contain these elements in the proportion plants require. This means they can be applied without great fear of "burning" plants or killing soil organisms. They can be used safely in situations where the organic matter content of the soil is not yet sufficient to sustain healthy plant growth.

On the other hand, mineral fertilizers such as lime, rock phosphate, gypsum etc. contain only a few elements, and in very concentrated form. Why would be ever want to use such potent substances?

The fact is, not all soils are created equal. I am not just talking about the sand and clay content, but also the mineral content. In urban environments much of our soil is fill, and it can be just about anything. Under some circumstances it may be useful to supply elements that are not sufficiently available in the existing soil – especially while the landscape is under transition to organic practices.

## Useful soil tests for organic gardeners

We can spend all kinds of money on all kinds of tests to find out all kinds of things about our soil - but how useful is that information in helping us make organic gardening decisions? After all our garden is not a lab but a complex ecosystem which thrives through the interaction of a great diversity of organisms.

The obvious starting point would be to check the 3Ms: mulch, microbes and moisture.

## Testing your mulch

There are two things you need to know, and neither requires expensive tests. All you need to do is loosen the soil surface and look.

1. How nutritious is the mulch – not just for the plants, but also for the microbes that need to break it down first? Bark mulch may cover the soil, but it really doesn't have much food value. In fact, it contains many natural toxins that inhibit microbial action – the exact opposite of what we are trying to achieve. Even in forest we won't find all the soil covered in bark.

Mother Nature mulches very simply and efficiently: all plant waste is recycled in place. In our ornamental gardens we may use compost and leaf mulch instead (or grass clippings on the lawn). The important thing is to create habitat and food for the thousands of critters, large and small, that slowly reduce it to smaller and smaller compounds that eventually become plant food.

2. How much mulch do you need? The denser your plants, the more food they require. My rule of thumb is to maintain at least 2" of mulch at all times. No amount of fertilizer can substitute for mulch!

## Testing for microbes

Finding out whether your soil life has the appropriate diversity can be a little more challenging. Sure, microbes and bugs are everywhere, but not necessarily in the right proportions to support plant health. In fact, plant diseases are just disproportionate populations of microbes that happen to eat living plants. In our ornamental gardens more often than not these unbalances are created through the use of pesticides and synthetic fertilizers – and insufficient mulch to support microbial diversity.

It is possible to test the numbers and diversity of soil microbes, but a basic microbial assay will cost about $120.00 CDN (plus shipping). And how important is it to know those details? Or in other words: what are the lab's recommendations likely to be? Can we skip the testing and proceed directly to the remediation?

Sure we can. All gardens will benefit from these practices, and that's all the lab would recommend anyway:

- Mulch with high quality compost. After all, compost is a breeding ground for microbes. Do not use sterilized compost – that would totally defeat the point!
- Apply aerated compost tea. The compost tea brewing process extracts and multiplies the microbes present in the compost. Home scale compost tea brewers are available to purchase over the internet, or you can even build your own. You can find lots of information about compost tea at this website: www.soilfoodweb.com/03_about_us/approach.html
- Apply EM – effective microorganisms. This is a commercially available mix of fermenting microbes, whose activity stimulates and supports all other soil ecosystem processes. Phone Phil Nauta at (250) 661-0383 (www.gardenerspantry.ca). You can find lots of information about EM at this website: www.eminfo.info

Seems too simple? All of these methods are practiced routinely by organic farmers, horticulturists and nursery operators across the world with spectacular results, and without the negative side effects of synthetic chemicals.

## Testing for moisture

Organically managed landscapes require moisture. Not just for the plants, but for the microbes as well. In fact, without sufficient moisture to support microbial activity our plants will starve, it's a simple as that.

So by all means practice efficient water management, but do not deprive your soil of water. If your mulch is dry, or the soil is dry below the mulch then you're not watering enough.

# The Limited Usefulness of Conventional Soil Tests

Conventional soil management treats soil like a nutrient bank. Each soil has a specific capacity to "hold" nutrients. Since plants withdraw nutrients from the soil these need to be replaced periodically in order to make further plant growth possible. To determine the type and quantity of chemicals to be added to the soil we then test for three factors:

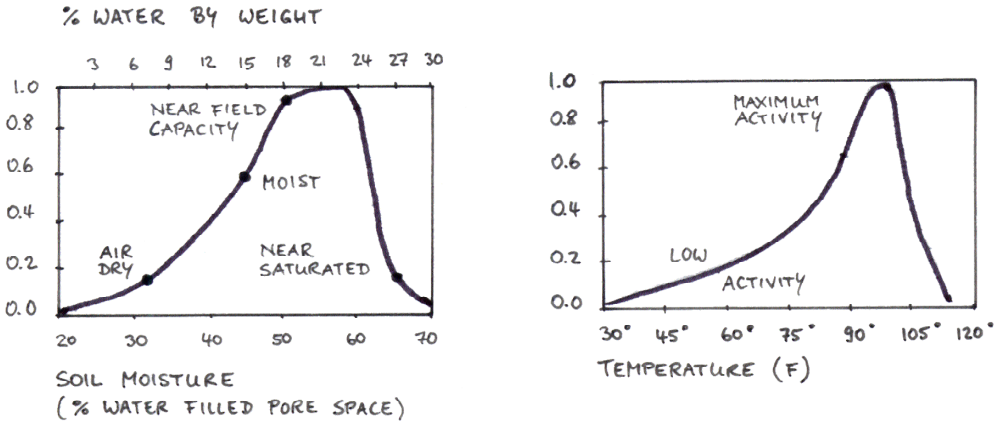
- Soluble nitrogen
- Mineral content
- pH

## Testing for Nitrogen

It is certainly possible to test the nitrogen content of soil, but the results are not very meaningful in an organically managed landscape. Plant growth – and their need for nutrients – is not uniform throughout the year, but increases with temperature. And Mother Nature has the perfect "just-in-time" delivery system: the speed of decomposition of organic matter is temperature dependent. This means that nutrients become available to plants just as they need them.

This is very fortunate in the case of nitrates, the preferred form of nitrogen for most plants, because due to their chemical structure they do not attach themselves to soil particles. In other words, they either get used quickly, or are lost from the soil forever through leaching or volatization.

So when our nitrogen test in the spring reveals little available nitrogen this only means that nature is working just fine: it's hanging on to this important element until plants need it. And provided our garden has sufficient mulch, microbes and moisture all will be well!




Illustrations by Christina Nikolic.
Based on:Conservation tillage Fact Sheet #3-95. Published by USDA-ARS, USDA-NRCS.

The graphs above demonstrate clearly how soil microbial activity depends on temperature AND optimal soil moisture conditions.

Adding additional nitrogen to our soil based entirely on nitrogen test results, without consideration of the quality of mulch and soil microbiology, would cause excessive succulent plant growth and insect (especially aphids, scales etc.) infestations.

The nitrogen soil test was designed for conventionally managed farms and landscapes that have insufficient organic matter to feed the vegetation. It is not particularly useful in organically managed landscapes.

## Testing for Minerals

By now you can recognize the common thread: organic soil management has very little to do with fertilizing, and very much to do with mulching and biodiversity of soil dwelling organisms.

But what do we do when our soil is truly “poor”? Certainly not all soils are creat-

ed equal. Their capacity to "store" minerals, and even their mineral composition differs substantially from place to place. Many soils do, in fact, have less than desirable amounts of essential plant nutrients, including micronutrients.

There is no need for despair. Brazilian soil scientist Ana Primavesi demonstrated that it's not the quantity of nutrients, but their quality and uninterrupted availability that's important! In other words, plants grown in mulched and biologically diverse but otherwise poor soils thrived above those grown in biologically dead soils and the regular addition of fertilizers.

So once again, how meaningful is the information provided by soil mineral tests in an organically managed landscape?

Here is how Elaine Ingham of the Soil Foodweb Inc. explains it:

*"What we want to know from chemical testing is: How much of a particular nutrient in the soil is available for the plant to take up? Do our current testing methods give us that information? Probably not. Does any soil test predict what the plant will take up? No.*

*Just like a person, just because the food is in the freezer, the refrigerator, or even prepared and on the table, does not mean we will actually eat it. Just because nutrients are in water solution does not necessarily mean the plant can or will take them up.*

*In the assessment of soil chemistry underway with researchers in Australia there is no soil in Australia that lacks phosphorous. Or boron. Or silica. Or any nutrient, except perhaps nitrogen. If agricultural practices have really beaten on the soil, sulfur may be low as well. But nowhere near zero, and certainly not limiting for plant growth for several crops at least.*

*The nutrients are in our soils. Only when soils have been hammered by poor agricultural practices, or by severe disturbances, should significant additions of nutrients be required. Otherwise, all you need is the biology to move the nutrients that are present, but sequestered and tied up in soil, into soluble pools for plants to take up.*

*So you can add the huge amounts of inorganic fertilizers recommended every year, forever, and destroy water quality at the same time, or add the biology needed, plus the foods to feed them, and*

*exit the toxic chemicals from your shelves.*

*You add back the nutrients needed for plants in the foods for the microbes. You only have to replace what the plant took out, which is perhaps a half ton of well-made aerobic compost per acre. In fact most of the time your plants themselves will add the needed foods: as long as you keep plant cover on your soil, the organisms will keep working for you."*

So what does that mean for us? If our soil has been highly disturbed (and many urban soils are), or chemically managed, it would indeed be useful to check the mineral composition of the soil.

Ideal soil should have approximately these nutrient ratios:
Calcium - 60 to 68% base saturation
Calcium: magnesium ratio – 10 : 1, or 7 : 1 for grasses
Phosphate : potash ratio – 2 : 1, or 4 : 1 for grasses
Potash : sulfur ratio – 1 : 1

Based on the test results, fertilizers can then be used for the short term to correct any mineral deficiencies until the mulch and soil biology have become established. If this seems too complicated, please consult a SOUL Certified Organic Land Care Professional.

Most homeowners, however, might as well spend their money on good organic soil management and some full spectrum organic fertilizers to tie them over for a couple of years, and skip the soil mineral test.

Whatever you do though, never use mineral fertilizers without a soil test. It's not only a waste of money, but it can do a lot of damage to your soil as well!

## Testing for pH

So far we have discussed how soil fertility works, useful soil tests for organically managed landscapes, and the limitations of soil nitrogen and mineral nutrient tests.

Now to the last of the common soil tests: pH.

Once again we need to ask: how meaningful is a soil pH test in the organic management of landscapes?

pH tests can in fact be very useful, but NOT in the way they are commonly used! You know the routine: based on your pH test you add mineral fertilizers (usually dolomite lime on the West Coast, or sulfur in the Interior) to your lawn or garden in an attempt to neutralize the pH.

Used this way the pH test is being substituted for a mineral nutrient test – and that's not what it measures! What it does measure is how much hydrogen your soil contains, not the amount of lime or sulfur. Why would anybody want to know that? Because the soil particles will "hold" either mineral nutrients or hydrogen, so a higher % of hydrogen means your soil contains a lesser % of minerals. It does not and cannot tell you which minerals are present, and to what proportions. Adding fertilizers to your soil based only on a pH test is outright negligent, and a waste of money. A pH test is supposed to be used in combination with other soil tests, not in lieu of.

But isn't a low or high pH bad for the plants? First of all, there are thousands of beautiful ornamental plants for every soil type, so it only makes sense to design your garden with plants that like to live there rather than trying to change your soil to suit the plants. Secondly it's simply not possible to permanently change your native soil pH. At best the effect will be temporary, requiring constant additions of minerals, at worst your soil will become depleted of "minor" nutrients through the chemical reactions that take place when we start treating the soil like a laboratory experiment.

Don't worry, once again Mother Nature has this all figured out. Experience has shown that as the organic matter content of your soil increases, the pH moves towards neutral all by itself. A pH test then becomes a useful tool to monitor the success of your organic soil management practices. If at the beginning of your conversion to organic practices your pH was 5, and two years later it's at 5.5 or 6, then you're doing a good job.

A word of caution: soil pH varies throughout the garden, and throughout the year. When making comparative measurements be sure to take your sample from the same locations, growing the same vegetation, at the same time of year, with the same soil moisture content and even soil temperature. Otherwise you are comparing apples to oranges, even with such a simple test.

## Summary

When our gardens are treated like ecosystems and managed in a way that supports natural processes there is little need for constant soil testing, or for constant additions of mineral fertilizers.

Exceptions are highly disturbed soil, soil that has been mismanaged through indiscriminate applications of fertilizers and synthetic compounds, or instances where the native soil is truly deficient in a specific element.

A soil mineral test will establish the "base line" and fertilizer program, and pH tests will help to monitor the progress. The most important "tests", however, focus on the 3Ms: mulch, microbes and moisture.